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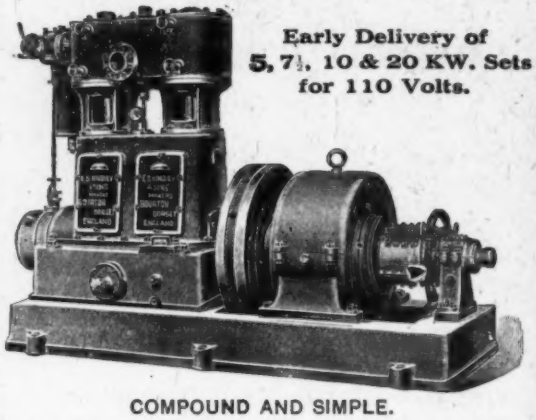

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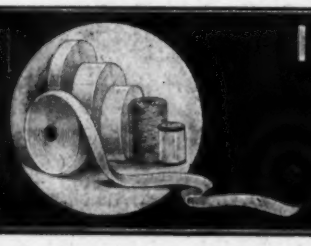

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THE DISPUTE IN THE ENGINEERING INDUSTRY.

THE daily Press of February 24th announced that the executive of the Amalgamated Engineering Union had decided to invite further conference with the Engineering and the National Employers' Federations on the subject of the lock-out threatened for March 11th. On Tuesday last such a conference took place, but no agreement was reached.

The Times of last Friday provides a concise history of the dispute which has led to this dangerous situation, and the crux of the question is the interpretation of the agreement between the A.E.U. and the Federations, made at the end of September, 1920. Our readers will not fail to note that at the time the agreement was signed trade had been booming for some time, shops were full, labour was fully employed, and many people thought that the prosperity under which we then lived would continue indefinitely. Those whose duty it was rather to look ahead than to administer the processes of manufacture already began to see the first signs of the coming slump. Orders were getting fewer, the operation of the contracts price adjustment clause was causing increased dissatisfaction, and the difficulties of selling were beginning to return. Those concerns—their name was legion—which had increased their output facilities began to see ominous signs that unless sales could be materially increased, those facilities would not be required, and might, in fact, become a millstone round their necks; and the more prudent began, even at the height of the boom, to make their arrangements accordingly. To the less prudent we are indebted for the crop of reconstructions and adverse reports of which we read every day.

At the height of the boom, then, when labour was scarce and the employers had plenty of work, both sides agreed, very properly, that systematic overtime was to be deprecated as a method of production, and they made certain conditions for its regulation. As always happens, the cruel grip of harder times has made both sides look carefully into what was meant by the agreement. In passing, we may observe that agreements between employers whose interests, while collectively the same, are individually different, are being carefully (in some cases feverishly) reviewed at the present time.

Systematic overtime was to be avoided, "necessary" overtime was to be worked, and certain emergencies were defined when overtime should be unrestricted. In cases other than the emergencies referred to, it was agreed that the question should, if desired, be raised and discussed in local conference, and also, if necessary, in central conference. It seems perfectly clear from this that in all such cases the necessity or otherwise of the overtime was to be matter for consideration by both parties. If instructions for overtime were issued by the employers,

those instructions appear to have been obeyed, subject to the right of the A.E.U. members to raise the question according to the proper methods provided. When the question was not raised, common sense leads us to the conclusion that the workers, while considering the point, did not disagree as to its necessity.

In April, 1921, a crisis on the question arose, and a struggle appeared imminent, but the miners' strike came along, and this was probably the reason why the conflict was abandoned. In November, 1921, certain terms were agreed between the employers and the executive of the A.E.U., which embodied, among other things, the common-sense provision to which we have alluded. The Union agreed not to interfere with the employers' right to exercise managerial functions in their establishments, while the Federations agreed not to interfere with the proper functions of the Trade Union. The agreement of April 17th, 1914, amplified by the Shop Stewards and Works Committees' agreement of May 20th, 1919, for the avoidance of disputes, was referred to, as well as any other national and local agreements between the parties; and these agreements were to guide both sides in the exercise of their functions. As we have said, the instructions of the management were in all cases to be obeyed pending the discussion of any question in connection with them. The employers were to have the right of deciding when overtime was necessary, the workpeople having the right to raise the question with regard to any case they desired discussed, proceeding with the overtime in the interval. The Executive, having regard to the depressed situation now existing, recommended the adoption of these terms, and they were submitted to the ballot of the members, who number some 407,000.

What happened? We are afraid that what happened, feeble though it be and disheartening to all who hope for better days in industry, must be described as the usual thing. Twenty-one per cent., or 85,765 only of those qualified to vote, went to the poll; 50,240 votes were cast for rejection of the terms, and 35,525 for their acceptance. The majority for rejection was 14,715, or 3.6 per cent. of the membership. What were the remaining 320,000 members about that they did not vote? Why did a similar thing happen about the vote on the withdrawal of the Churchill bonus? We are obliged to admit that we are unable to answer these questions. It is foolish in the extreme to struggle for power and then to neglect to use it, and Mr. J. H. Thomas has told the workers over and over again that if they will not take the trouble to make their wishes known in the proper way, they will have only themselves to thank for the consequences. Those consequences will be that action will be taken in accordance with the views of those who *have* taken that trouble, and then, of course, we shall hear of "direct action" and other desperate remedies.

We see, then, what is in dispute. The employers do not want to discuss overtime with the shop stewards or works committees. Sir Allan Smith states it in two ways: (1) Is industry in this country to be carried on on a Soviet basis or on the basis of private enterprise? and (2) are employers entitled to manage their works themselves or must they do so by consent of the men and their representatives, and subject to the latter's right of veto? We are inclined to agree with a Labour correspondent's view in *The Observer* of February 26th that Sir A. Smith is not justified in dragging in the red flag. As to the second question, we would answer by asking, first of all, what has become of all the pious resolutions in favour of Whitleyism, co-operation, and pulling together, of which we heard so much a year or two ago? Sir Allan Smith goes on to say: "The issue is not confined to the engineering trade. It affects all industry." It is to be presumed that he has some authority for speaking after this manner with regard to other industries, though we must confess we do not know what it is. And we are not alone in our ignorance on this point, for in an editorial article on February 24th *The Times*, after pointing out that while mistrust exists on both sides, the way to remove it is by frank discussion with a genuine desire for peace and understanding, with clear definition as regards the terms used, goes on to remark: "These things have been successfully done in other industries, and can be done in the engineering industry."

There is a note of impatience in this comment which may well warn both parties that the country is not out for disputes at the present time. The overburdened taxpayer, struggling to make ends meet, has no use for anyone, employer or employed, who rushes on to the industrial stage waving a red flag and shouting "Bolshevism!" or "Anti-Bolshevism!" Get on with the work! is the national sentiment to-day, and it is right. There must be co-operation, and it must be full, frank, and hearty. There must be devolution, not centralisation, of responsibility. We have done our best for years to make this clear. Why is one side to claim that its only alternative is "to face the situation and, in the national interests, to place the industry on a sound and economic basis?" Any industry—all industry—can be placed on a sound and economic basis by one means and one means only—frank discussion *with a desire for peace and understanding*. Autocracy in business must go. During the troubled days of the war it appeared to have gone, but as in the case of the North-countryman who, thinking he was dying, became reconciled with his son, there seems to have been a proviso: "If I get better again, this counts for nowt!" Evil practices that were set aside during the bad times rear their heads again—wage-cutting, output restriction, stubbornness on both sides, and a lack of desire for accommodation.

The A.E.U., with 27 per cent. of its members unemployed, has paid out since July, 1920, the gigantic sum of £2,162,307 in out-of-work pay. It is thus helping to bear the national burden, and, in our opinion, deserves on this ground alone something better than to have its members locked out as the result of a ballot at which nearly 80 per cent. did not trouble to vote.

By all means let there be further discussion, and let both sides try to understand each other's difficulties. Now that there is a movement among the dry bones of industry, and we may look forward to breath coming into them, it cannot be allowed to happen that the engineering trade shall be the means of deferring the hopes and sickening the hearts of the people.

The I.E.E. Jubilee.

The Institution of Electrical Engineers is to be most heartily congratulated on the signal success of its Commemoration Meetings last week, which lacked but one element to make it complete—the presence of the President. We are sure that all our readers will join with us in an expression of sincere sympathy on the enforced absence of Mr. Highfield from the various functions which he himself initiated and largely organised with a view to the appropriate celebration of this unique occasion.

Unique it was in many ways; particularly in that it will never be possible at any future period to hear from the lips of the veterans who took part in the epoch-making struggles of those pioneering days, their own account of their unforgettable experiences. A special tribute is due to Dr. Fleming, whose lecture on the immortal Faraday, profusely illustrated with reproductions of Faraday's own experiments, and inspired with the romance of that historic 10-days' work, could have been excelled only by the utterance of Faraday himself. No lecturer could have a greater privilege than thus to tread in the steps of that great discoverer and to make him live before us again for an hour, if only in fancy.

In the course of the Commemoration an immense amount of ground was covered, and the special issue of the Institution *Journal* containing the record will be of absorbing interest. Curiously enough, the subject which was of paramount importance 50 years ago received less attention than would appear to be its due, seeing that the foundation of the Society of Telegraph Engi-

neers was directly due to its development—namely, that of submarine telegraphy. So far as we are aware, although financiers who supported the Atlantic cable project were named, no mention was made, before an audience of engineers, of the engineer who, in the words of Sir Henry Mance's presidential address, "pre-eminently distinguished himself in the development of oceanic telegraphy." Lord Kelvin himself also, in a presidential address to the I.E.E., said: "To Sir Charles Bright's vigour, earnestness, and enthusiasm was due the successful laying of the Atlantic cable. We must always feel deeply indebted to our late colleague as the pioneer of that great work, when other engineers would not look at it, and thought it absolutely impracticable." Clearly, therefore, it was largely to the work of the late Sir Charles Bright, that not only the Atlantic cable, but the Society of Telegraph Engineers itself, owed its existence, and we greatly regret that the fact was absolutely overlooked.

The well-earned homage paid to the splendid achievements of Mr. Oliver Heaviside will command the approval of all who are acquainted with his work—a labour of love, for his reward has been grotesquely inadequate; we trust that the Institution will not allow the matter to rest where it is.

To the message of Mr. Highfield and the masterly address with which Mr. Atkinson closed the proceedings we will refer in a later issue.

The North Metropolitan Power Co.'s Bill.

The North Metropolitan Electric Power Co.'s Bill, recently introduced into the House of Lords, has by virtue of one of its clauses created a somewhat unwonted interest among the undertakers in the Administrative County of London. The general purpose of the Bill is, of course, to enable the North Metropolitan Electric Power Co. to absorb its Distribution Company, which is a more or less domestic matter. The interest for outsiders, however, rests not in this, but in Clause 15. This clause is a very simple one; it enables the North Metropolitan Co. to supply in the Administrative County of London any electricity which it purchases from the Metropolitan Railway Co. or the London & North-Western Railway Co. In its Bill of 1914 the North Metropolitan Co. was empowered to purchase and distribute electricity bought from these two railway companies, but it was specifically debarred from supplying such electricity in the Administrative County of London. This proviso was inserted in the Bill on the strong representation of undertakers in London, the L.C.C., and others. The new clause removes this restriction.

The question which exercises the minds of the London undertakers is what the North Metropolitan Co. intends to do if it gets this extended privilege. Reading the clause literally, it means that the North Metropolitan Co. could sell electricity in bulk or retail to all undertakers or consumers who had distributing areas or premises adjacent to any railway lines of the Metropolitan Railway Co. or the London & North-Western Railway Co. This is obviously a big order. The effect would be just the same as if these two railway companies were given power to supply electricity to all consumers or undertakers who could be reached by their lines. As the Metropolitan Railway Co. runs through some very important industrial areas, a large number of undertakers are directly interested. The clause covers this much at least. On the other hand, it might possibly cover even a much wider field. The clause does not say that the electricity sold by these two railway companies to the North Metropolitan Co. must necessarily be generated at their stations at Neasden or Stonebridge Park. If the clause covered any bulk supply sold to these railways themselves *by other bodies*, it might conceivably mean that the North Metropolitan Co. could buy from any line or sub-station on the whole of the London underground system of railways.

It seems fairly obvious that the North Metropolitan Co. does not intend simply to tack on isolated consumers in a piecemeal fashion. The Company must be credited with wanting to do something on a bigger scale and something more businesslike. But up to the present no one appears to be able to give a very good guess as to exactly how these powers are to be used. On the other hand, it is plain that, by such indefinitely wide powers, the various London undertakers' interests are or may be most vitally affected. In virtue of such possibilities, as well as minor points, the London County Council has put in a very strong petition, and there are similar petitions from London undertakers.

Further, outside the question of affecting individual interests, this clause has also an incidence on the electricity scheme for Greater London. The North Metropolitan Co., under the Commissioners' provisional scheme, will be invested for its own area with certain of the powers of the Electricity Commissioners, and the Company is supposed to bring up some sort of comprehensive scheme within the next two or three years. The remainder of the London and Home Counties Electricity District, and especially the Administrative County of London, is dealt with, for the time being, separately. The idea of the Administrative County of London is, of course, to get some sort of order out of the present chaos. The situation, as everyone knows, is complicated enough at the moment—but if the North Metropolitan Co. (which is at present supplying no one in the Administrative County, except in bulk to two boroughs adjoining its area, namely, Stoke Newington and Hackney) is now going to be authorised to arrange for supplies to be given indiscriminately over London from Stonebridge Park and Neasden, or elsewhere, then, indeed, the situation will be in "a pickle."

However, this is a matter which lies in the hands of the Electricity Commissioners to a great extent, since it is amongst their duties to report to the House of Lords on the Bill. In the meantime the Bill retains, so far as this clause is concerned, a good deal of the piquancy of the unknown.

Montevideo Tramways.

Uruguay is not at the moment in good odour with the British trader owing to the unfortunate dispute between the municipal authorities at Montevideo and the British-owned tramway company there. The Spanish traction company in the Uruguayan capital has been somewhat similarly affected. For about four years these organisations have been endeavouring to obtain official permission to raise their fares in order to compensate for the increasing costs of operation, due chiefly to taxation and local legislation. Their position was rendered more difficult by a strike. This, however, was settled, the men returning to work voluntarily; but because the management refused to take back certain of the ringleaders the Uruguayan Government appears to have declined to consider further the applications for permission to increase the tramway fares. Various attempts followed to obtain legislative authority for the increase, conditional upon a higher wages schedule, and a special committee to which the whole matter was referred recently recommended this course. However, the municipality, apparently with the tacit approval of the State Government, took possession of the British tramway company's system and raised the wages of the employés, seizing the company's funds to pay the men the increased wages promised. This drastic action, coupled with the unsatisfactory character of the negotiations generally, is not likely to attract British capital and enterprise to Uruguay, and for the sake of all parties it is to be hoped that the representations which it is understood that our Foreign Office is making will lead to a proper settlement.

Uruguay needs the help of British financiers and British engineers; it is in fact inviting both in connection with the large programme of port works at Montevideo. Some details of these extensions and of other proposed public works are given in a report recently issued by the Department of Overseas Trade.

D

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(*Concluded from* 272.)

The turbines consist of high- and low-pressure portions, the former casings being of cast steel and the l.p. casings each exhaust through double-flow discharges into two condensers, an arrangement which enables the diameter of the l.p. elements to be kept small, makes it possible to retain a high factor of safety, and at the same time secures high steam efficiency. The governors, of the mechanical type, are arranged so that they can be adjusted either by hand on the turbines or by means of an electrical control device from the switch-house. Further, a mechanical safety governor is also provided which will interrupt the steam supply to the set should its speed rise to 3,300 r.p.m.

The condensing plant, figs. 8 and 10 (as well as the boiler feed pumps), was supplied by Messrs. G. & J. Weir, Ltd., of Glasgow, and consists of two sets of twin condensers, air ejectors, water extraction pumps, &c., the condensers being of the surface type, supported on springs and direct coupled to the exhaust flanges of the turbines. The condenser shells are coupled together in parallel, and are provided with cast-iron end doors which, in turn, are fitted with several cast-iron hinged manhole and mud doors which make it possible for the whole of the tube plates to be cleaned without removing the end doors. The condensate is circulated in a closed circuit on the Weir system, which arrangement eliminates the absorption of air by the feed water on its way to the boilers. The condenser water extraction pumps are coupled on to the same shafts as the motors which drive the ventilating fans that cool the generators, as shown in fig. 10. Each twin condenser is provided with two air ejectors, one of which acts as a stand-by; the discharge from the steam ejectors is utilised in the boiler feed-water heater, which is of the surface type, and is so arranged that it can be isolated and by-passed on both the water and steam sides.

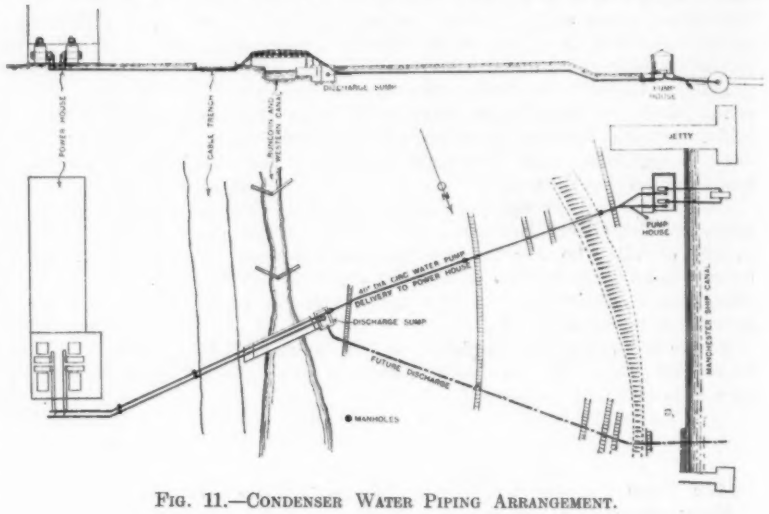

Fig. 11.—Condenser Water Piping Arrangement.

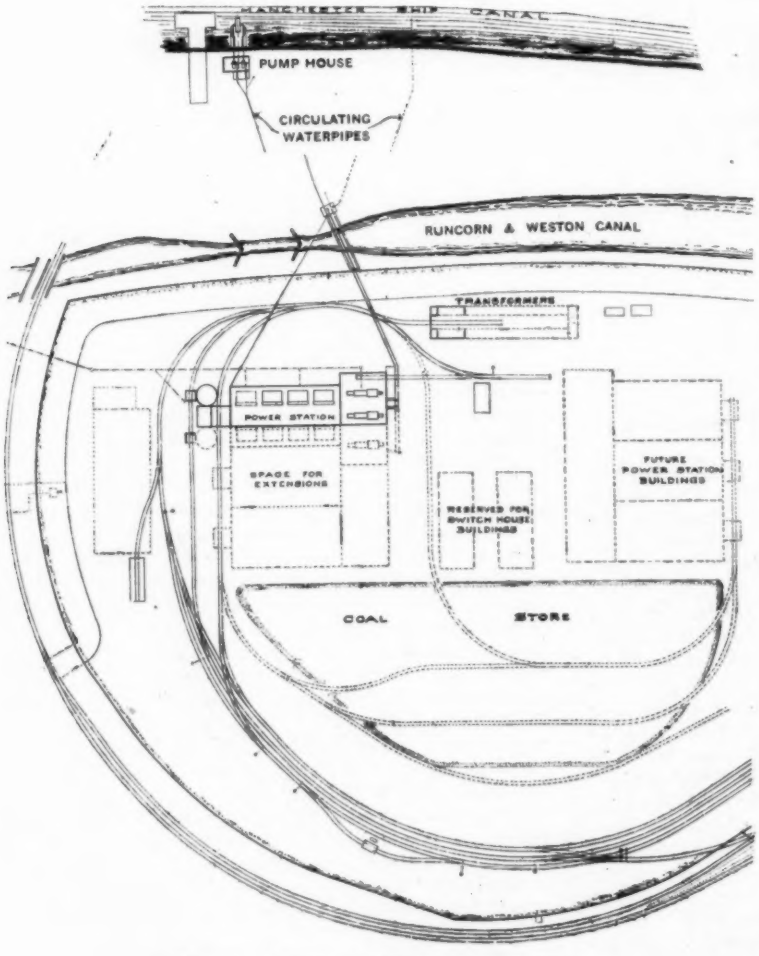

Fig. 12.—Layout of New Runcorn Station.

The condenser cooling water is derived from the Manchester Ship Canal, and is supplied from a pump-house situated on the bank of the canal, which runs parallel and adjacent to that of the River Mersey. The building houses the two pumps illustrated in fig. 9, each of which is capable of delivering 14,000 gallons of water per minute and being driven by a 350-h.p. electric motor supplied by Messrs. J. H. Holmes and Co., of Newcastle-upon-Tyne. The suction pipes are carried on a 40-ft. jetty out into the canal and terminate in a screen which they enter through trunnions. The screen removes all *débris* from the water; it was built by Messrs. Brackett & Co., of Colchester, and is capable of screening 30,000 gallons of water per minute. The drum is kept constantly rotating by means of an electric motor and worm gearing, which, it will be seen from fig. 7, are accommodated on the jetty without any covering whatever. In order to keep the screen

clean, jets of water play upon its upper inside surface, and all the *débris* thus dislodged is collected in an iron trough. The whole of the screening gear was so designed that it obviated the use of under-water cement or piling. The arrangement of the delivery pipes is well illustrated by the diagram, fig. 11, from which it will be understood that the pipe line extends from the pump house for a distance of some 120 ft. to the turbine house and crosses the Runcorn and Western Canal by a 40-ft. span steel

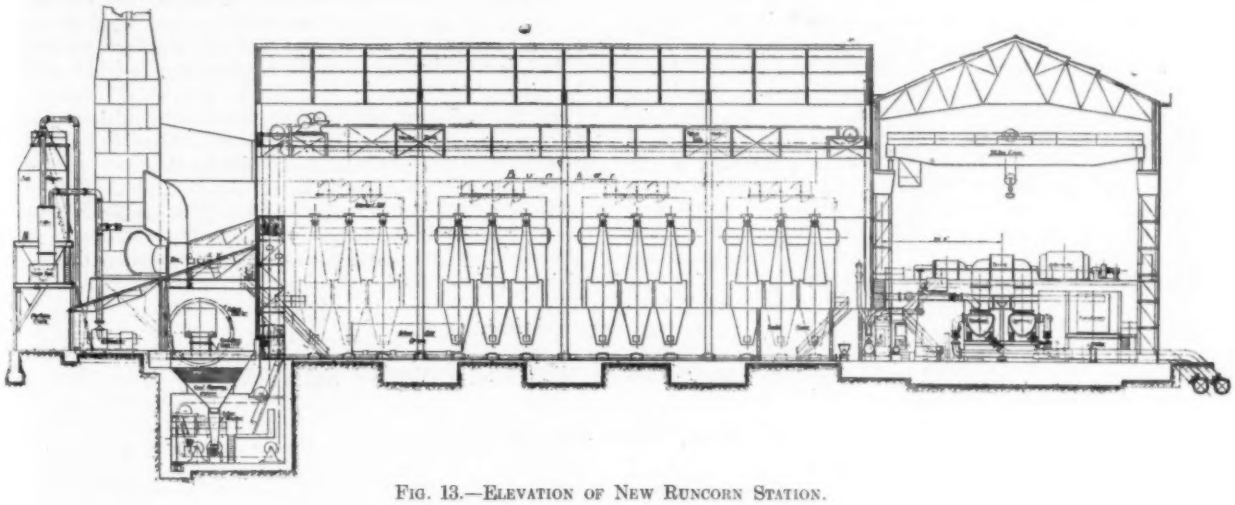

Fig. 13.—Elevation of New Runcorn Station.

bridge. The used water is conveyed back over this bridge and discharged into the Runcorn and Western Canal, thus affording assistance to the Manchester Ship Canal Co., Ltd., in maintaining the level of the canal.

The two main generators are each rated for a continuous output of 12,500 kW at a speed of 3,000 r.p.m.; they generate three-phase, 50-cycle energy at a pressure of 6,450 volts. The machines are of the rotary-field type, their exciters are direct driven, and their ventilating fans, one of which has already been referred to and illustrated in fig. 10, are each capable of supplying 50,000 cu. ft. of air per minute.

The main switchboard, of which figs. 5 and 6 are front and back views respectively, is housed in a plain brick building, and is entirely separate from the power house and about 100 ft. from the turbine room; it is a temporary structure, and when the station is completed the switchhouse will be located in the position indicated on the lay-out diagram, fig. 12. The board is built up of polished black slate, is hand operated, and controlls the two turbo-generator sets, the open-air step-up substation, and feeders, Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, having specially designed it. The bus-bar panel, with a generator panel on either side of it, occupies the centre of the board, the remainder of which is composed of feeder panels, all of which are provided with Merz-Price overload and balanced protective gear. The whole of the switchgear is of the ironclad pattern, each switch being immersed in a steel tank filled with oil, and the station auxiliary plant is all controlled by means of two additional Reyrolle switchboards, one of which is situated in the boiler-house basement and the other on the turbine platform. The whole generating station is controlled from the switch house, a complete system of telephones, telegraphs, indicators, &c., having been installed for that purpose.

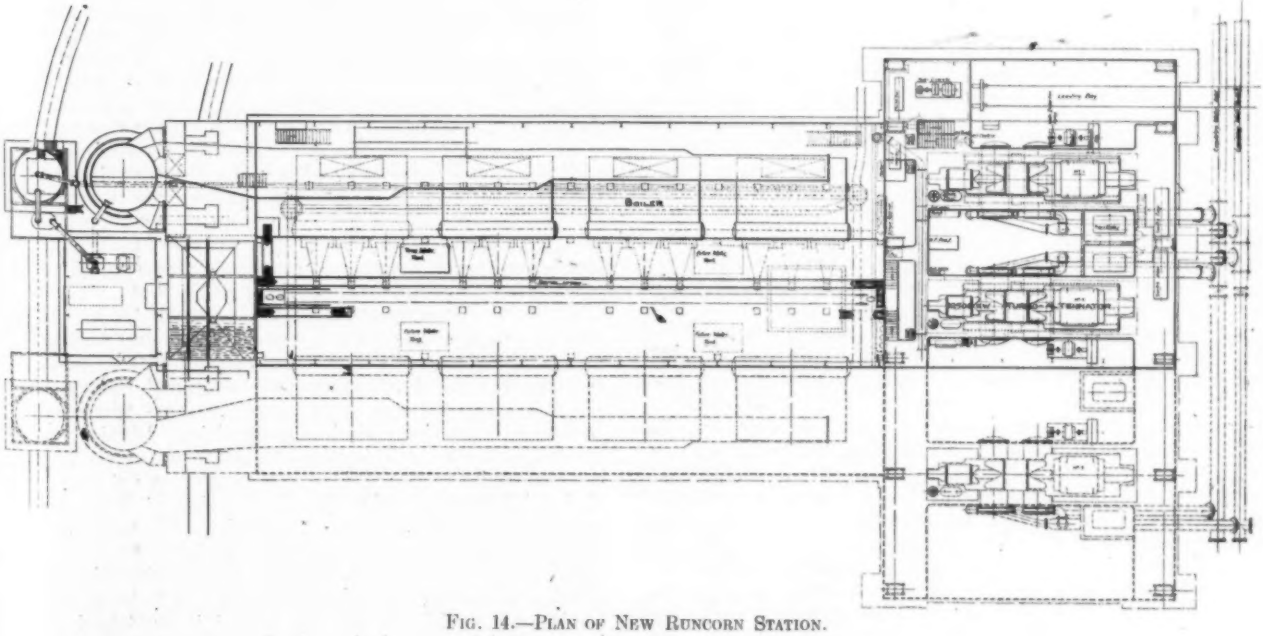

Fig. 14.—Plan of New Runcorn Station.

Energy is transmitted from the generating station to Ellesmere Port by means of two feeders that operate at a pressure of 33,000 volts. The generated pressure is stepped up for that purpose by an outdoor transformer station that is illustrated in fig. 4; it is com-

posed of two banks each containing six 1,667-kVA transformers that were supplied by the Metropolitan-Vickers Electrical Co., Ltd., of Manchester. The transformers are cooled by oil, which, in turn, is cooled by circulating water round the oil coolers, for which purpose two small rotary pumps are provided and are housed in two brick buildings at the end of each bank of transformers, as seen in fig. 4. In addition to the station cabling, the main 33,000-volt transmission line was supplied by British Insulated & Helsby Cables, Ltd., of Prescot.

The station lighting was arranged by the Mersey Power Co., Ltd., and is carried out at a pressure of 110 volts; the circuits can be supplied from either a transformer or a battery of accumulators. The latter was supplied by the Tudor Accumulator Co., Ltd., of Dukinfield, and consists of 63 cells having a normal discharge rate of 80 amperes with a maximum of 120 amperes; the battery is charged by a motor-generator set, and is located on the turbine gallery above the battery room. Behind the set is the 110-volt switchboard (part of which is to be seen on the left-hand side of fig. 2), and was supplied by Messrs. J. H. Holmes & Co., of Newcastle-upon-Tyne, to control the battery, station lighting, and motor-generator circuits; it consists of six black enamelled slate panels. An electrically-driven high-pressure pump (to be seen in the foreground of fig. 8) is provided to supply the water service for cleaning and fire-lighting purposes; a novel feature of the latter arrangement is the fact that the pipes forming the hand rails round the galleries and roof, &c., have been fitted with nozzles and utilised to serve as the water supply mains.

A plan and sectional elevation of the station are reproduced in figs. 13 and 14, while a good idea of the general lay-out of the station, railway sidings and circulating water arrangements is given by figs. 11 and 12 respectively.

In conclusion, it remains to express our indebtedness to those concerned for permission to publish the above details, and to thank Mr. J. E. Nelson (engineer to the Mersey Power Co., Ltd.), Mr. R. L. Johnston (station superintendent), and Major G. A. Bruce (under whose supervision the new station was erected) for the loan of plans, drawings, and assistance on the occasion of our visit to Runcorn.

BRAZILIAN RAILWAY ELECTRIFICATION SCHEMES.

[From our Special Correspondent.]

Few contracts for railway electrification in South America have attracted more attention, or called for keener competition, than that decided upon by the Federal Government of Brazil for the electrification of the Central-of-Brazil Railway. The fact that this, the most important main-line of the largest South American Republic, has proved a financial failure from its inception would alone have induced the Government to seek the best method of economical management; but, as a fact, the present Government, like its two immediate predecessors, has long been desirous of availing itself of the immense—and practically untouched—water-power in Brazil, which, according to all accepted authorities, could be made to provide some of the finest hydro-electric installations for transport purposes in the world. In Brazil, as in other parts of the globe, whenever the question of electrification has been taken up the matter of increasing the capacity of a section of steam-railway has been the great factor, rather than reduction in working expenses; but, to-day, the high price of coal has brought the latter factor into the greater prominence.

Although the Central system extends to something over 2,200 km., the electrification of only a small portion of the main line is to be dealt with as a preliminary. A start will be made in the suburbs of Rio de Janeiro, in connection with which the work is to be concluded within a period of two years. At the same time other portions of the system will be taken in hand, part of which will have to be ready for traffic within three years, both periods counting from the date of registry and approval by the Tribunal de Contas. Work will be started upon the lines of the Central Station-yard, and followed by eight freight lines between the departure end of the Central Station (Rio de Janeiro) and the entrance of the elevated line next to the large depository warehouses of Sao Diogo (1,000 metres). A third section will be that dealing with the yard-lines of the Depository, while another will be the lines of access to the Maritima Station and those of the respective yards. Other sections will be: lines of access of the Central Station to the respective car-sheds; the lines of access for the projected station-yard for merchandise adjoining the Mangue Canal, as well as those of the respective yard; four traffic lines from the beginning of the elevated line next to the Depositary of Sao Diego as far as the Engenho de Dentro Station (a length of 10,070 metres); two traffic lines from the Deodoro Station to Bolém, on the line from Centro, and that of Santa Cruz on the Santa Cruz branch (39,468 metres and 32,544 metres respectively); a traffic line between Belém station and Paracamby station (8,306 metres); a circular line from D. Clara Bangu to Mataduro, and the line of access from the Deodoro station to the car-sheds, where are also established cleaning and repairing sheds for rolling-stock. Finally, all the lines belonging to this undertaking will be electrified.

Although proposals submitted by foreign contractors will be received up to March 30th next for the electrification of the stretches of line referred to, the operation of traction and transport material, the construction of sub-stations and various other improvements, it is not thought at all probable that a final decision will be arrived at; the belief is general that a new "edital" will have to be issued owing to strong objections which exist locally with regard to the terms set forth in the Government proposals. Although the Brazilian Government has sought upon two continents for the best possible technical advice with regard to the system of electrification eventually to be adopted, opposing views exist, not only in Government but in engineering circles, with regard to the relative advantages of the direct and alternating-current systems of electrical operation, while there exist interests bitterly opposed to the introduction of any wide system of electrification. Similar disputes were in progress nearly three years ago, when an Anglo-Italian Syndicate offered to the Brazilian Government to undertake the electrification of the Central Railway, and a French syndicate submitted to the same Administration a competitive similar proposition. Again, at the end of 1920, the Government called for tenders for the electrification of the same system over an extension of 109 kilometres, while the Commission of Finance made all arrangements for the opening of a credit to cover the cost of changing from steam to electricity on the suburban lines from the Central Station in Rio de Janeiro to Deodoro, Barra do Pirahy, Santa Cruz, Paracamby and Maritima. At that period it was hoped to interest British electrical engineers in the Government proposals, and they were invited to get into touch with the Inspectoria Federal das Estradas Ministeria da Viacao e Obras Publicas.

Other South America countries have been interested in the heavy trunk-line electrification projects of the United Kingdom, which, indeed, appear to have been very carefully studied, since they are frequently referred

to by South American consulting engineers in their reports; while, in certain instances, standard British plans have been adopted practically complete by engineers advising their governments on steam-railway electrification. It was hoped, therefore, that the experience of British engineers in developing reliable heavy railroad equipment would prove of considerable help to the Brazilian Government, and might have resulted in the negotiation of a valuable contract. Little disposition to participate in the enterprise, however, was then shown, and the efforts of His Majesty's Commercial Secretary in Rio de Janeiro to conjure up something like competition on this side proved conspicuously unsuccessful.

It is hoped on the present occasion that more interest will be displayed, notwithstanding the terms which the Brazilian Government has, somewhat unwisely, decided to impose. These conditions include the provision of a bond of 200 contos of reis from each competitor, guaranteeing the signature of the contract, while only those competitors will be considered suitable who can prove, in addition to sufficient financial backing, that they have already furnished and installed large installations of electric traction, including installations for shunting in large railway-yards. To still further guarantee the execution of the contract once awarded, the successful competitor's bond will be raised to 500 contos of reis (£25,000).

The principal difficulty that British and other foreign contractors will have to contend with in competing for this no doubt desirable foreign contract will be the lack of technical knowledge possessed by the responsible advisers to the Brazilian Government. This drawback has been noted in times past when other engineering contracts, of almost equal importance, have been under consideration. Unsettled opinions of specialists are scarcely likely to prove less vital in connection with the electrification scheme referred to, especially at a time when discussion is raging in other parts of the world with regard to the relative advantages of the different systems of electrification and the number and diversity of types of electric locomotives still under trial.

In this latter contract thirty locomotives will have to be furnished, ten for freight and twenty for passenger trains.

Should all threatened difficulties be overcome and the Central Railway of Brazil be converted to electrical operation, and if the system could be operated at even 70 per cent. of its capacity, it would, for the first time in its history, be able to pay a dividend, estimated at no less than 8 per cent., allowing for a gross revenue of 7,000,000 milreis. It is thought, moreover, that once the electrification scheme is carried to completion the saving of fuel alone would be so great that, even with the incubus of the enormously swollen *personnel*, the Central Railway could be made to pay. Much, of course, depends upon the eventual construction cost of the electrification, which necessarily must be extremely high at the present time.

By the time that the Central Railway is ready for operation under the new auspices, it will be possible to compare its working with another electrified line, the first to be introduced in Brazil. This has been under construction for some considerable time, and is now practically completed. The construction of the line between Jundihy and Campinas, a distance of 45 kilometres (or about 28 miles), belonging to the Paulista Railway Co., has been carried out by the International General Electric Co. The line being double-track, the total mileage, including switches and extra track, amounts to 76 miles. The equipment has been supplied by the same company, and consists of twelve locomotives —eight freight and four passenger engines—material for the transmission lines and sub-stations, and a 3,000-volt overhead system of distribution.

It is proposed to carry out further extensions on the same system amounting to 100 additional miles of route, which will eventually bring up the total electrification to 128 miles, extending between Jundihy and Sao Carlos. Power for the operation of the lines will be supplied by the Sao Paulo Light & Power Co., at 88,000 volts, 60 cycles. In this case the electric locomotives will be of the General 3,000-volt type. The freight locomotives will weigh 100 tons each, all weight on driving axles, and the passenger engines 121 tons each, equipped with two axle guiding trucks at each end, with a horse-power of 2,000 and 65 m.p.h. maximum speed. Two others, destined for freight, will weigh 87 tons each, with a h.p. of 1,500 at the same voltage and a maximum speed of 40 m.p.h. All alike will be equipped with regenerative braking apparatus.

GLASGOW'S LABOUR-SAVING HOUSES.

The Corporation's "All-Electric" Experiment.

From time to time we hear of the wonderful labour-saving appliances that are used in American and Canadian homes. Similar dwellings are, though it may not be generally known, available in this country—the *Daily Mail* modern village, Welwyn Garden City, in Herts. and the houses at Middlesbrough, Edinburgh, Glasgow, and elsewhere may be cited as examples.

The two houses at Riddrie that have been fully equipped electrically and specially furnished throughout for demonstration purposes by the Glasgow Corporation Electricity Department, with a view to encouraging the use of domestic electrical appliances, were officially opened on February 14th by Bailie Sadler; they were to remain open for public inspection for a fortnight in the hope that the experiment will aid in convincing visitors that a judicious use of electrical apparatus is the obvious means of reducing housework to a minimum. With the coming of electricity into English homes, the drudgery of housekeeping will disappear, and women's energies will no longer be largely devoted to slaving in the kitchen.

The Riddrie houses, as will be seen from fig. 1, are semi-detached standard 5-apartment buildings, the ground floor consisting of a living room, parlour, scullery, and larder, while on the upper floor there are three bedrooms and a bathroom. When building the houses, fireplaces, flues, and chimney heads were omitted, thus effecting a saving of £40 per house. East House is completely equipped for lighting, heating, cooking, hot-water supply, and washing by electricity; in the living room of West House, however, an open coal-fire grate has been provided to meet the double purpose of heating the room and water; a boiler behind the grate supplies all the hot water needed in the scullery and bathroom. Tests are being carried out with the "smokeless" fuels now on the market and, if the results are satisfactory, it is hoped that it will be possible to dispense entirely with the use of raw coal in domestic premises and thus approach a stage nearer the "smokeless city" of our dreams.

The equipment of both houses is similar, and includes a complete electric lighting installation; examples of the latest types of lighting fittings are to be seen in the various apartments, and it is worthy of note that the use of electric light enables unique decorative and furnishing effects to be obtained, while the provision of floor and table standard lamps, with their delicately-coloured silk shades, adds the necessary charm. Special attention is directed to the new pattern of electric night light that has been installed in the small bedrooms; it is invaluable for the nursery or sick room, and its use,

it is claimed, enables 200 hours of light to be obtained at a cost of 6d.

All the rooms are heated electrically, and the absence of fireplaces, especially in the bedrooms, enables full use to be made of all walls in setting out furniture and, in addition, effects a considerable saving in building costs. Ventilation is by means of small gratings located in the upper part of the walls, and the type of electric heater provided for use in the bed and bathrooms is said to cost only ¾d. per hour to run. The great advantages of electric heating are its cleanliness and convenience. The source of heat can be brought very close to the point of application; radiators can be placed in any required position, or moved from room to room, and, unlike coal fires, they give their maximum heat immediately the electricity is switched on, which remains constant without attention, and use can be made of them for short periods efficiently. The abolition of coal fires eliminates half the work of housekeeping—and that the dirtiest half, too.

Fig. 1.—Two "All-Electric" Houses at Riddrie, Glasgow.

Fig. 2.—A View of the Parlour.

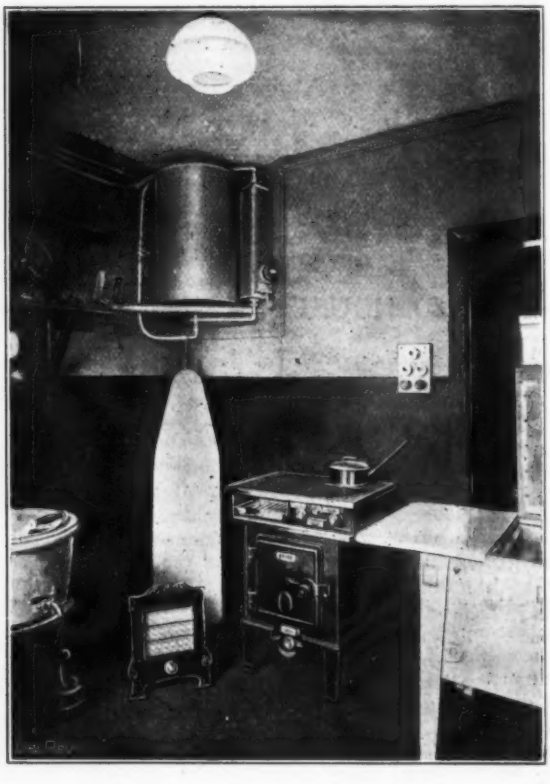

Fig. 3.—A Corner of the Scullery.

With regard to the electrical devices that have been provided in the individual rooms of the houses, the bathroom contains a radiator, a shaving mug, and a towel-rail heater, while in the bedrooms there are an immersion heater, a bed warmer, fan, vibrator, milk warmer, hair drier, a curling-tongs heater, and a violet-ray medical outfit.

In the living room there are provided such things as a coffee percolator, teapot, toaster, a plate warmer for the sideboard, and a table grill, all heated electrically, besides a vacuum cleaner. The interior of the parlour is illustrated in fig. 2, from which it will be seen that, although not necessary, a fireplace in which an electric radiator stands has been provided to satisfy traditional expectations, as well as an electrically-driven sewing machine, pianola, or gramophone; a cigar lighter, floor and table lamp standards are also included.

It is in the scullery that what may be termed the heavy electrical apparatus is housed, for it will be seen from fig. 3 that an electrically-heated calorifier with a 20-gallon storage tank and a 3-kW circulator supply all the hot water needed for the sinks in the scullery and for the bath and basin in the bathroom. An electric instantaneous water geyser is also provided, and it is intended that the water used at breakfast time should be boiled by means of a 3-pint electric kettle. An electric cooker, of the type that can be hired from the Glasgow Corporation Electricity Department, is installed, as well as an electrically-operated dish-washing machine, a clothes-washing machine, and an electric clothes boiler; such small devices as a radiator, fan, iron and collapsible ironing table, and a "Hoosier" kitchen cabinet complete the equipment.

The outstanding advantages of the use of electricity—such as its safety, cleanliness, convenience, ease of control, &c.—are too well known to need emphasis in our pages; nevertheless, the Glasgow Corporation is to be congratulated on its enterprise in aiding the popularisation of the domestic uses of electricity. It is to be hoped that many who thus for the first time are afforded an opportunity of seeing a modern home, not only lighted electrically, but equipped with modern electric labour-saving devices and conveniences, will not rest content until they have seen similar appliances installed in their own homes.

In conclusion, we may draw attention to an important experiment which was carried out by the Glasgow Corporation in 1918, when two tenement houses were fitted up with electrical apparatus for all domestic purposes, and accurate records were kept. The results were set out in an article by Councillor Denny, of Glasgow Town Council, entitled "A Study in Load Factors," which was published in the Electrical Review of May 28th, 1920, p. 675. It was there shown that if all the houses in Glasgow were similarly equipped, the output of energy for domestic purposes would be no less than 2½ million kWh per annum.

THE BRITISH INDUSTRIES FAIR.

(*Continued from page 282.*)

Birmingham Section.

The opening of the Birmingham Section of the Fair on Monday was attended by cold but bright weather, although rain fell in the afternoon. There were very few visitors, as is usual on first days of these exhibitions. Building C, which was full last year, is this time almost wholly utilised for storage purposes, and a smoking room occupies space as well. This indicates that a falling-off has occurred, and we notice that one or two large firms which exhibited last year are now unrepresented, although the arrangements have been improved. The majority of the stands appear to have altered little, as regards exhibits, from last year, and although the display as a whole is imposing enough, and no doubt from a buyer's point of view (which is the point of view that matters) up to standard, in electrical productions, there is little that is new to be seen.

Messrs. Petters, Ltd., exhibit a number of their engines operating on petrol, paraffin, gas, or crude oils. One of the most interesting exhibits is the 1.5-h.p. "Petter Junior" engine (fig. 3), which the firm has recently placed on the market. This little engine starts up from cold by means of a small quantity of petrol and then changes over automatically to paraffin fuel. The engine is of the two-stroke type and its principal feature is a special fuel oil ejector, which ensures the complete vaporisation of the supply. A "No. 1 Petterlight" set is shown. This consists of a 2.5-3 b.h.p. "Petter-Junior" engine belt-driving a 1-kW d.c. generator, together with a 14-cell, 125-Ah battery. A larger lighting and power set also has space on the stand—a 3-kW generator direct-coupled to a 5-b.h.p. engine. A pumping set is shown, comprising a "Petter Junior" engine coupled by a belt to a double-acting brass lined pump, with a delivery of 1,000 gal. per hour. A form of "Petter Junior" engine for marine work is also exhibited. Apart from these small engines the firm also shows a 10-b.h.p., semi-Diesel engine, one of a range of such machines designed for operation on crude and residual oils or refined petroleum. This is a single-cylinder engine, with a 7¼ in. dia. piston, working at 425 r.p.m.

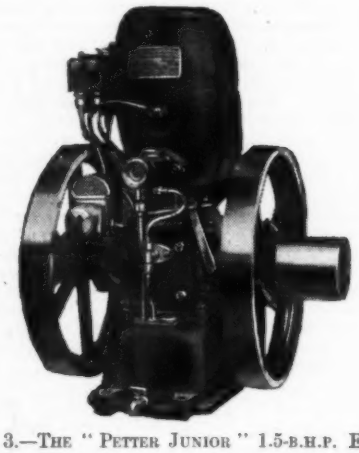

Fig. 3.—The "Petter Junior" 1.5-b.h.p. Engine.

Messrs. Tangyes, Ltd., show one of their heavy-oil engines. This is capable of starting up from cold without the use of a heating lamp and suitable for working on very low-grade fuel oils or on fuels such as alcohol, benzine, or tar oils. The engine is fitted with a patent spray-maker, which superheats the fuel before it passes through a non-drip fuel nozzle into the combustion chamber. The firm also exhibits a gas engine with a suction gas producer. Other exhibits are a 300-ton hydraulic press; steam pumps for boiler feeding, &c.; and a vertical high-speed steam engine.

The Heatly-Gresham Engineering Co., Ltd., also shows a number of oil engines of small power. These are of the vertical type with totally-enclosed crank chambers, ensuring freedom from dust for all moving parts. The engines are designed for oil fuels, or, by a slight modification, for operation on town gas. A number of small lighting and power sets are shown, fitted with dynamos made by Electromotors, Ltd. Other features of the company's exhibit are:—A standard battery-charging switchboard by Messrs. Crompton & Co., Ltd.; a model storage battery, by Messrs. Pritchett & Gold & E.P.S. Co., Ltd.; oil engines coupled to centrifugal pumps, air compressors, and exhausters; and steel castings, pressings, and forgings.

Messrs. Crossley Bros., Ltd., show several examples of gas and oil engines, ranging from 6½ to 34 b.h.p. An interesting exhibit is a suction-gas plant for an engine of 21 b.h.p. This is of the Crossley patent open-hearth type, which permits of easy inspection and cleaning. Two engines suitable for electricity works are shown, the "O.E. 117" developing from 28 to 31 b.h.p., and the "O.E. 1075" of from 7½ to 8½ b.h.p.

The National Gas Engine Co., Ltd., presents examples of engines made at its works. The largest is a 44-b.h.p. size, complete with a suction-gas plant fitted with a conical grate giving a uniform supply of gas at all loads. A 14-15 b.h.p. town-gas engine, and a 7½-8 b.h.p. "National" oil engine are also shown. The representatives of the smaller sizes are a 2½-3 b.h.p. gas engine and charcoal gas plant; and a 5-6 b.h.p. vertical engine (suitable for gas, oil, or petrol) coupled to a 3-kW, d.c. generator.

The Electric Power Engineering Co. (Birmingham), Ltd., shows two small lighting and power sets. One of these consists of a 4-cycle water-cooled engine direct-coupled to a 1.5-kW generator. Every rotating part of the plant is fitted with ball or roller bearings. A 2.5-kW set is also exhibited, as well as a range of small motors and dynamos, all of which are provided with ball-bearings; switchboards and batteries; electric polishing machines, &c.

Messrs. David Shanks & Co., Ltd., have a large display of plain and artistic lighting fittings. A notable feature is a range of English alabaster bowls, and fittings for such applications as church, theatre, and public building lighting, are shown in variety. Country-house lighting is represented, as well as fittings designed for ships. Several electric signs are also exhibited.

Messrs. J. H. Tucker & Co., Ltd., show among other things, four examples of small accumulator switchboards, specially designed for small low-voltage private plants. There are also numerous types of tumbler switches, many of which are finished in high-class style in various metals. Ironclad switch and fuse gear, distribution boards, and a large variety of small lighting and heating accessories—lampholders, plugs, adapters, bell-pushes, &c.—also appear.

Messrs. J. B. Stone & Co., Ltd's., principal exhibit consists of "Wilson" patent nibbling machines. These are specially designed for the rapid cutting of shapes in metals and other materials of thicknesses up to 3/16 in. Their possibilities may be gathered from the fact that they can deal with either cast steel or fibre. The cutting is effected by means of special steel punches and can be carried out at an average speed of 18 in. per minute. The cut edges are not compressed nor do they need filing after leaving the machine. The machine is made in three sizes, rated according to the size of the gap between the punch and the body of the machine.

Messrs. Clayton Wagons, Ltd., show a number of examples of drop forgings consisting principally of automatic, gas-engine, and electric vehicle components.

The Falkirk Iron Co., Ltd., this year has its electrical products displayed on a separate stand. A number of the firm's cookers, arranged with separate switch controls, are shown. The "5301" model has a total loading of 6.9 kW, which embraces two 3-heat 8-in. hot-plates, a 6-in. hot-plate, a grill-toaster, and the oven elements of 2 kW. A smaller type (No. "5280") is exhibited; this model secured a silver medal at last week's Cookery and Food Exhibition. A number of "Double Ray" heaters appear. The "Double Ray" is a new heater of American design for which the Falkirk Co. has been given sole manufacturing rights for Great Britain, &c. The heater consists of a semi-cylindrical brass stamping, in the centre of which is mounted a hollow spirally-wound element of 600 W. The top and front are of strong wire, and the bottom is ventilated, so that in addition to the direct "radiant" heat, a current of air passes through the bottom and through the element. Several small cookers are shown, as well as models specially designed for hotel use. The firm also displays several ornamental fires in various metal finishes, including a very effective antique silver one. Other exhibits are electric irons, including a new size of laundry iron weighing 8 lb.—a compromise between the ordinary domestic type and the tailor's iron. The arrangement of the stand is excellent; in the background are two fires and a cooker "framed" in recesses.

The Metropolitan-Vickers Electrical Co., Ltd., has a display of numerous "Cosmos" appliances, including kettles, grills, hotplates, irons, &c. A new fire is shown. This has a long curved reflecting surface at the back of a straight cylindrical 2-kW element, in which the wire is wound into the core. A fan of new design is also shown; this is of substantial construction with brass blades, heavy base, and strong wire guard. Art metal fittings of various kinds, made at Harcourt's, the company's Birmingham works, are exhibited, in-

cluding several designs of wall lighting fittings in the Adam and Louis XVI styles; beautifully wrought bowl rings bearing bowls of unique design; switch plates; door fittings, &c., in different metal finishes. For the rest, the exhibit consists of industrial lighting fittings and small electrical accessories.

The Austin Motor Co., Ltd., has as the main feature of its display examples of its automatic dynamo (fig. 4). This is a ventilated enclosed machine, with self-contained switchgear, suitable for direct coupling or belt driving, with bolted-on laminated main poles and regulating poles of solid forged steel. The commutator end shield is extended to form a case for the automatic controlling switchgear. The armature is of the slotted drum type and former wound, and the commutator is of liberal proportions to permit of "third brush" voltage regulation. The switchgear is so arranged that the plant can be fully automatic, self-starting, stopping and regulating when controlled by a relay; semi-automatic; or hand-controlled but self-regulating. A two-way switch, magnetically or hand controlled, connects the dynamo to the battery, and when the

Fig. 4.—The Austin "Auto-dynamo."

latter is fully charged, the dynamo is disconnected and the load switched on to the battery. Push buttons are provided to enable these operations to be carried out by hand, and special windings on the machine regulate the voltage at the lighting terminals to compensate for variations in load and the state of the battery. All current-carrying parts are enclosed. The controlling relay is mounted above the bracket, and has incorporated in it a time-element reverse-current cut-out and indicator. An ammeter or volt-ammeter is provided. The machine is made in two sizes, 1 and 2 kW. The firm's other exhibits are a 2-kW automatic lighting plant and a .75-kW "Autoplant" suitable for supplying light and power to country houses, hotels, &c. The former set is an "auto-dynamo" coupled to an engine capable of operating on petrol, benzol, or town's gas.

Messrs. Crowther & Osborn, Ltd., have an exhibit showing the various stages of manufacture of the "Sceando" lamps, from the glassware (which is of the firm's own manufacture), through the wire-drawing, sealing-in, and exhausting to the completed lamp. We understand that the gasfilled lamps are made according to the firm's own patents.

Messrs. Wm. McGeoch & Co., Ltd., have an extensive display of electrical apparatus. Among this is a new form of "unit-type" switchgear, with substantially protected switches and fuses; the bus-bars are in explosion-proof chambers. A Navy type switchboard of sound construction is shown, as well as examples of interlocked switch and fuse-gear, ships' navigation lights and light indicators, and lighting fittings of many descriptions. The company also exhibits examples of electric train couplers similar to those supplied to the London Electric Railway, and an electric solenoid-operated train-door lock arranged for control throughout a train from the guard's van.

Premier Electric Heaters, Ltd., has a display of well-finished heating and cooking apparatus. This includes kettles, irons, an electric cooker, fires, carbon-filament lamp heaters, &c. A small bowl fire is shown; this is of strong construction and neat appearance. It is fitted with a flat wire guard so that the bowl may be tilted into an upright position, where it is retained by a spring, for boiling or food warming.

Messrs. Wm. Whitehouse & Co., Ltd., have a tasteful show of lighting fittings of all types—bowls, table and floor standards, silk shades, &c. A noticeable feature of the display is the finish carried out in imitation of various metals.

Ornamental lighting fittings are also exhibited by Messrs. Best & Lloyd, Ltd., Sperryn & Co., Ltd., John A. Harry Hunt, David Shanks & Co., Ltd., and many other firms.

The Foster Engineering Co., Ltd., shows many examples of transformers, ranging from the small bell-type to a 350-kVA, three-phase type. "Apex" quick make and break switchgear is shown in various sizes and combinations, and an outstanding feature of the stand is a motor driving a crank which continually "makes" and "breaks" a small double-pole "Apex" switch. An indicator for use in ships is exhibited. This consists of an indicator to be fixed in the steward's quarters and small light indicators placed outside the cabins. When a bell is rung, the cabin light is switched on, and remains on until the steward attends and switches it off. This firm also shows a fire alarm consisting of a metal disk, which, when expanded by heat, completes contact in a buzzer circuit. An application of one of the transformers is to a standard spot welder for use on sheet metal of thicknesses up to ¼ in.

The British Cellulose & Chemical Manufacturing Co., Ltd., has a great number of articles made from its non-inflammable celluloid, "Celastoid"; a number of bowl fittings are included in this display.

(To be continued.)

London Section.

At the London section of the Fair, which is being held at the White City, Shepherd's Bush, there is to be seen an entirely novel type of electric motor on the stand of Messrs. Wedekind & Co., driving the "Spellad" advertising sign. At present, this motor is made in fractional horse-powers up to 1 h.p. only, but it possesses many potentialities as, whilst being remarkably small and light for its power, it can be run at speeds of from 750 r.p.m. to under 10 r.p.m. without gearing of any sort. The power is obtained by utilising harmonic vibrations generated by an alternating electric current, and this method dispenses with the need for armature, commutator and brushes. In its simplest form, the motor consists of an electro-magnet with a vibrator connected to a spring-tensioned tape passing round the shaft or pulley to be driven. The vibrations cause waves in this tape, and these waves cause the shaft or pulley to rotate; the amazing fact is that the rotation is always in the same direction according to the way in which the tape is wound, and the shaft does not merely swing backwards and forwards.

A new feature is the appearance of a joint exhibition of kinematographic apparatus equipment by the Incorporated Association of Kinematograph Manufacturers, Ltd., under the auspices of which many of the United Kingdom members of the kinema industry provide attractions for the visitor interested in this sphere of activity. For example, a number of the sound workmanlike British projectors now on the market are to be seen in addition to a large variety of accessories. Arc and incandescent lamps for use in conjunction with projectors are exhibited, as is also a small portable petrol-electric generating set that can be carried about on a one-ton lorry. On the stand of Messrs. Geo. Palmer (Universal Cinemas Supplies), Ltd., there is a gramophone the music from which is transmitted electrically along twin wires and reproduced at a distance by means of a loud-speaking horn.

Electrically-operated gramophones are also shown by Messrs. Electric Gramophones, Ltd.; Artistic lamp shades made of silk, parchment, &c., and hand painted so as to match vases that have been adapted for table lamps and to harmonise with the colour scheme of room decoration are exhibited on a number of stands by Miss M. B. Low, the Artistic Shade Co., Messrs. Ellis, Simpson & Saunders, Messrs. S. L. Miller and Co., Messrs. F. Parks, Ltd., Mr. Charles Selz, and Messrs. Louis Wolff & Co., Ltd. Messrs. Livermore and Knight, Ltd., have on view "Mystery" revolving shades which are caused to revolve by the hot air that rises from the lamp and passes through a metal vane fitted in the top of the shade as a sort of horizontal windmill.

Other exhibits of interest are those of the Ever-Ready Co. (Great Britain), Ltd., portable electric lamps, dry cells and batteries; Erinoid, Ltd., an artificial horn-like material that is said to have good insulating qualities for electrical work—and Dictograph Telephones Ltd., a loud-speaking inter-office telephone, a special feature of which is that there is no mouthpiece or earpiece to hold.

The large stand occupied by Messrs. X-Rays, Ltd., is well worth visiting by those interested in the medical applications of X-rays.

Social Events.—Under the auspices of the Athletic and Football Club of the Bradford Corporation Electricity Department, a whist drive and dance took place on February 21st at the Textile Hall.

The local staff of the General Electric Co., Ltd., held their annual whist drive and fancy-dress dance at the Heaton Assembly Rooms, Newcastle-on-Tyne, on Friday last. The company numbered over 200.

THE ELECTRICAL CONTRACTORS' ASSOCIATION (INC.).

Coming-of-Age Dinner.

On Monday last the Electrical Contractors' Association (Incorporated), together with the allied N.E.C.T.A., Ltd., and the National Federated Electrical Association, held its "Coming-of-Age" dinner at the Hotel Cecil, February 1st being the 21st anniversary of the meeting at which it was decided to form the Association, as reported in the Electrical Review of February 8th, 1901. Mr. J. Orringe (president) occupied the chair, and there was a good attendance of members and guests, the latter including Mr. C. H. Wordingham, C.B.E. (past-president I.E.E.), Mr. Councillor E. C. Ransome, J.P. (president E.D.A.), Mr Ll. B. Atkinson (director C.M.A., and past-president I.E.E.), Mr. J. Macgregor (chairman C.M.A.), Mr. H. Boden How (chairman E.W.F.), Mr. H. G. Purchase, M.P., Mr. D. N. Dunlop (director B.E.A.M.A.), Mr. J. W. Beauchamp (director E.D.A.), Mr. F. B. O. Hawes (hon. sec. E.T.B.I.), Mr. A. G. Beaver (hon. secretary E.W.F.), Mr. A. H. Dykes (hon. secretary Assn. Cons. Engrs.), Mr. J. T. Holmes (vice-president A.M.A.), Mr. E. S. New (secretary A.M.A.), Mr. L. Gaster (secretary Ill. Eng. Society), Mr. L. G. Tate (secretary), and many other well-known electrical men.

After the loyal toast Mr. J. Macgregor proposed "The Allied Association and Honorary Officials," congratulating the Association on attaining its majority, and remarking that it was good for the members of an industry to be associated, and to enter into close relations with other associations. By following that method they were now in a position to maintain the electrical business of this country and to overcome foreign competition.

The President, responding, said the first meeting was called together by Mr. H. Alabaster, of the Electrical Review, and was held in February, 1901, at Anderton's Hotel, Fleet Street, Mr. Alabaster presiding. Contractors from all parts were present, and a provisional committee was formed. In May the National Electrical Contractors' Association was duly constituted at a meeting over which Mr. H. Bland presided, and Mr. Thos. Guthrie was appointed hon. secretary. In January, 1902, Mr. W. B. Rawlings was elected the first president, and in September, 1904, the Association was incorporated. Mr. Orringe read a letter from Mr. Alabaster (who was in the South of France) conveying his good wishes, and added that evidently Mr. Alabaster moved in the right direction, as shown by their presence that night. He held that every contractor should be a member of the Incorporated and Allied Associations, whose affairs were in the hands of reasonable men, who could look at matters from the point of view of the manufacturers, electricity supply authorities, and consumers, as well as their own. He would welcome the day when every manufacturer was a member of his own association; the closer they could get together the better. There was a spirit of co-operation abroad; the contractors were out to support the British manufacturer, and recognised their responsibilities. They were on good terms with the I.M.E.A., whose president (Mr. S. T. Allen) unfortunately was prevented from attending, but sent a message of goodwill. There were 750 contractor members of the Association; he claimed that they represented the cream of the contracting industry, and were in a good position to push forward the development of the industry. The contractors realised that it was for them to open showrooms and promote sales for manufacturers; they had not done all that they might have done in the past, but they were going to push sales effectively. The E.D.A. was doing a great work, and was worthy of support.

Mr. T. E. Alger proposed "The Guests (I.E.E. and kindred Associations)," complimenting the I.E.E. on its jubilee, Royal Charter, and roll of 10,000 members, on which every contractor should put his name. If contractors had been slow to recognise their responsibilities they were now awake to them.

Mr. C. H. Wordingham responded, advocating closer union between the contractors and the I.E.E. Members of the E.C.A. had done splendid work on the Institution committee. The revision of the I.E.E. Wiring Rules was in progress, and they looked to the contractors for assistance, as no one knew better than they what was wanted. Standardisation of fittings, &c., was also very necessary, but the standards put forward so far had not been largely adopted. As bulk supply became more general supply engineers would be able to pay more attention to the distribution side of their undertakings; they should work hand-in-hand with the manufacturers and contractors, organise demonstrations of electrical appliances and hire out apparatus. Municipal authorities certainly should not sell fittings or do wiring, but some way should be found to enable a consumer to acquire apparatus by hire-purchase. This might be done through contractors, who also should have a share in the showrooms, so that apparatus exhibited could be sold on the spot. E.D.A. would be of great assistance in this connection.

Mr. Councillor Ransome also responded, claiming that the multiplication of associations in recent years made for the good of the industries concerned, as well as that of the public. There was a tendency to superimpose on individual advertising a general advertising propaganda for the whole industry; E.D.A. was doing this, and had already materially assisted in the development of the industry.

Mr. R. Robson proposed "The Electrical Trades Benevolent Institution," which he said was well advertised in London, but not in the provinces; more local advisory committees should be formed, and everyone in the electrical trades should become a member.

In the absence, through illness, of Mr. Fletcher (the chairman), Mr. F. B. O. Hawes (hon. secretary) responded, expressing gratitude for the great help given by members of the E.C.A. He emphasised the importance of obtaining a large number of members, and urged contractors to become members in order to set a good example to their staffs. Last year the membership was increased by 60 per cent. by the efforts of the local committees.

Mr. W. A. Shaw proposed "The Chairman" in a racy speech, pointing out that the president had to devote the greater part of his time to the affairs of the Association.

Mr. Orringe, responding, said he had been in office ever since he joined the Association, and it was a real pleasure to him to serve electrical contractors, whether members or not.

A sweepstake set on foot by Mr. Robson brought in £15 5s. for the E.T.B.I., and a golden sovereign provided by Mr. Taylor was put up for auction by Mr. W. Riggs, the amount realised for the fund, including the sweepstake, being £50.

An excellent musical entertainment, under the direction of Mr. E. L. Halford, F.R.C.O., was performed by Miss E. Clifford, Mr. J. Humphries, and Mr. A. Nicholls, and the proceedings in all respects were thoroughly enjoyable.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

German Grip on Swiss Industry.

In your issue of February 3rd, you published an article entitled "German Grip on Swiss Industry." Your are doubtless aware that a similar article was published by *The Times* which, however, was rectified on February 3rd, as per enclosed copy.

Under these circumstances I should feel extremely obliged if you could see your way, in your next issue, to publish a statement correcting the inaccurate information conveyed by your article.

You will allow me to point out that Messrs. Sulzer & Co., of Winterthur, who are and always have been a Swiss firm, have kept entirely free from any foreign influence whatsoever: the capital is in Swiss hands, and Swiss money is invested in its many foreign branches.

As to the general statement that Swiss industry is being absorbed by the German "Holding" syndicates, I beg to state that there is no reason whatsoever for such an assertion, and that neither can it be upheld that there is a German grip on Swiss industry.

I should feel it a great favour if you could bring this to the notice of your readers.

Henri Martin.
Conseiller de Légation et Attaché Commercial.

London,
February 22nd, 1922.

[The report referred to was reproduced, with credit, from *The Times*. The second dispatch from *The Times* Geneva correspondent, rectifying the statements in the first, was published in the Electrical Review for February 10th, p. 196.—Eds. Elec. Rev.]

Rural Electrical Installations.

The proposal made by Mr. J. M. C. Field in his article in the Electrical Review, of February 10th, 1922, entitled "Electricity for the Country Dweller," amounts to a limited co-operative scheme. The idea is not new, and it was in process of formation when the war commenced in 1914. The idea as evolved by the writer at that time went further than the indications given by Mr. Field in that the ultimate burden of costs, both capital and running, would be borne in direct proportion to the demand by anyone who cared to take current, thus making the scheme an unlimited co-operation, and entirely self-supporting.

The suggestion that profit should not be made does not appear to be good. Certainly sinking or reserve funds or both should be formed, even if no further cost be reckoned to allow for dividend. Dividends might easily be dispensed with, especially with the small capital involved, but the whole costs ought to be shown, even if written off by counterbalances.

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The chauffeurs now usually to be found in our rural districts are the men to compensate with free light for their efforts in connection with the scheme, and with these men, intelligent and trained to engine work, relays for continuity of service could easily be arranged. The village schoolmaster will make an excellent secretary on the same basis.

The great object to be kept in view is to secure the interest of the villagers themselves. A judicious canvass, showing how much advantage could be obtained, even for the money at present spent on the primitive forms of lighting, would be sure to have a good effect.

There would not be any real difficulty in providing for the wiring of the smaller houses and charging-up the capital in the cost of energy. With the correct allocation of the various costs the burden could easily be made equitable to everyone concerned, and every additional consumer would reduce the average cost to each. Meters are out of the question. Limit switches are essential, the limit suggested being about 25 per cent. of the installation. Exceptional cases can be decided by the committee of management.

Let not the available water supplies be overlooked, especially for the day-load power services, of which there are many.

The development of the scheme is easier for a small town than for a village, because of the closer proximity of the majority of the dwellings. The more paying load will be from the smaller houses, as their group arrangement permits of shorter mains, and the wiring costs would be less *pro rata* than for the larger houses.

To make a charge for energy on the basis of a percentage of lamps or appliances installed is the most equitable solution of the problem of paying the costs.

T. A. Locke.

Winchester.
February 13th, 1922.

[Abbreviated.—Eds. Elec. Rev.]

Deposits on Specifications.

With reference to Mr. W. H. Pearce's letter, I fully endorse his remarks. The reason why corporation bodies ask for deposits is to force the firm applying for the specification to quote, but owing to the unknown contents of these specifications it is very often impossible for them to do so.

It is an unwritten law that the firm supplying goods is under an obligation to the firm purchasing, but if the purchasers make their conditions such that it is not worth while for the selling firm to quote, then the purchasers are the losers. Whenever deposits are required on specifications we do not apply for them, and if other firms would take the same stand the objectionable practice would soon be discontinued.

W. F. Higgs,
Higgs Brothers.

Birmingham,
February 22nd, 1922.

Mathematical Misconceptions.

I fail to see the proper connection in the article under the above heading from the opening pages of the Review for February 24th last. To my knowledge nearly every teacher of Mathematics tells us that "It would be very interesting to plot the curve, and note the general shape." They go on to say "in dealing with problems on maxima or minima we could get the result from actually plotting the curve and so a knowledge of the differential calculus would be unnecessary, but that plotting the curve is a laborious process and time can be saved by differentiating." But the same teacher tells us, "that to test for a maxima or a minima, when the result has been obtained by differentiating, we take the second differential, &c., &c.," and to impress on us how the application of d^2y/dx^2 tests for maxima or minima we have to plot the curve, plot dy/dx, and plot d^2y/dx^2, for only in this way can we get a true idea of the problem. Hence plotting the curve (which shows the "no material change") is adopted.

J. Plummer,
Student 3rd year Mathematics.

London,
February 25th, 1922.

[We fear we are "not young enough to know everything," and unlike our correspondent, we have not had the advantage of studying the methods of "nearly every teacher of Mathematics"; we are glad to learn that Prof. Perry's advice is followed so very widely.—Eds. Elec Rev.]

A Combination Fan and Heater.

Further to the letter of Mr. L. O. Meyer in the "Correspondence" columns of this week's issue, under the title "A Combination Fan and Heater," wherein he states that Mr. V. Gillgan has obtained a provisional patent for a device which combines an electric fan and heater, I may mention that I was granted a patent on August 18th, 1921, specification No. 167,702 for "A Variable Hot and Cold Radial Direction Electric Air Diffuser," which is a combination of a fan and heater.

The most important claim is its advantage in diffusing the air in any desired radial direction, the attainment of which is derived by means of detachable conical vanes, and is applicable when requiring either medium heat, hot or cold air.

Another important feature is that the air displacement is of a soft diffused nature, so distinct from the present-day type of fan.

H. Ashdown.

London,
February 25th, 1922.

Electrically Heated Oil Filters.

In reply to "Filter," the following is a description of an electrically-heated oil filter which we have fitted up for dealing with the oil for Diesel engines and from which we get very good results.

The oil from the Diesel beds is first pumped to a settling tank 12 to 14 feet above the engine-room floor level; the outlet from this tank is taken 4 in. from the top and brought straight down to the filter proper. It is best to make a visible discharge by means of a tap and funnel half-way down this pipe; it also simplifies cleaning-out operations.

The filter proper consists of a circular tank 14 in. diameter x 3 ft. high, which has an outlet tap 10 in. from the bottom and another 12 in. from the bottom; this tank is on a circular rim or stand, inside which are five 500-watt Belling bars connected to three switches giving any combination from one to five bars.

The pipe from the top settling tank goes inside the filter tank to the bottom and is L-shaped, having a number of 3/16-in. holes drilled along the base of the L. The filter is filled to the level of the first tap with water, which is brought to a temperature of about 200 deg. F., and the oil from the settling tank is admitted. An overflow pipe from the filter is taken from about 2 in. from the top to a final settling tank, about the same size as the filter, but set at a lower level; on entering the final settling tank the oil passes through a canvas bag which collects any impurities still left.

The idea of the two taps on the filter is that the one 10 in. up allows of the water level being maintained, and the second 12 in. up allows the draining-off of sludge which collects on the top of the water after the oil has passed through it from the L pipe.

I find that after the water and oil in the filter have been brought up to working temperature, one or two bars are sufficient to maintain the heat, according to the quantity of oil passing through.

E. J.

February 22nd. 1922.

In reply to "Filter's" inquiry for an electrical heater for an oil filter, the writer has had a home-made heater in use for some years with good results, which may interest him. It is only applicable to small and medium-size filters, and in this case is working on a "Wells" No. 3 filter. It consists of an ordinary carbon lamp inserted sideways in the top of the clean oil compartment so as to just clear the middle (or filtering compartment) when the latter is placed in position. A 16-c.p. lamp is able to heat up the full quantity of dirty oil that can be placed in the filtering compartment sufficiently to pass it through both pads in about three hours.

It would appear at first sight that the heat from a lamp would be insufficient, but owing to the position in which it is placed it is quite able to do all that is needed. The application of local heat also lengthens the life of the filtering pads, as quite a lot of sediment is thereby deposited in the filtering compartment which would otherwise pass into the pads.

An overflow pipe is fitted to prevent the level of the filtered oil rising dangerously near the lamp, and the arrangement is thus quite safe.

Electrical heating has one very decided advantage in that it enables the filter to be located in the cleanest available position without reference to the position of steam or exhaust pipes. It is surprising that filter manufacturers have apparently forgotten electricity as a heating agent, and yet there is no doubt that an electrically-heated filter would meet a long-felt want.

S. A. Hooper.

Carlow,
February 23rd, 1922.

With reference to "Filter's" inquiry in your correspondence columns of the 17th instant, I also have been very interested in this problem recently, and have been pleased to find that Messrs. Chadburns, of Bootle, have in use with their portable De Laval oil purifier (which, at the present moment, seems to be the only clean practical method of dealing with the purification of oils on the spot where the oil is to be *used*) a very effective heater. This is particularly shown in the illustration reproduced in your issue of September 16th last.

I have recently been handling one of these portable outfits, which was built in America. The oil to be dealt with is drawn from tanks by means of a pump on the outfit and pumped through an electric heater on its way to the purifier. This heater takes the form of immersion elements installed in the pipe circuit. The loading is up to 6 kilowatts, regulated in three steps. When the purifier is passing 300 gallons

of oil per hour it is necessary to have the full heat on to raise the temperature of the oil from atmospheric to 130 degrees Fahrenheit. The design of the heater is very practical, but this is being improved upon in several ways, one of the most important being that in future it will be constructed entirely in this country.

I shall be pleased to supply any further information of my own experience, and I am sure Messrs. Chadburn will put all their data before anyone interested who cares to apply to them.

N. W. Prangnell.

Newcastle-upon-Tyne.
February 20th, 1922.

[Messrs. George Nobbs, Ltd., The Jackson Electric Stove Co., Ltd., Messrs. Jeffcock & Parsons, Ltd., and The Dowsing Radiant-Heat Co., Ltd., inform us that they supply electrical heaters for oil filters.—Eds. Elec. Rev.]

The Fetish of the Quick-make and Quick-break Switch.

The letter from Mr. C. W. Denny, *re* "Quick-make" and "Quick-break" switches in your issue of the 24th February, is of much interest. The catch-phrase "quick-make" has become so prevalent that the real meaning and value of the "quick-make" is often lost sight of. The value, it seems to us, lies in the fact that the "make" is independent. In other words, the control is taken out of the hands of the operator. This may not be of much importance in small tumbler switches, but the effect is quickly seen in the larger capacity switches (10, 15, or 25 amps., 220 volts) when placed in the hands of, say, a small child.

It is as likely as not that a child would use the radiator control switch, or the fire switch, as anyone else, when installed in the home. Naturally the "independent make" is not of such importance where the switch receives skilled attention.

Generally speaking, it may be a great weakness to rely entirely upon the spring to carry the contact blades home, and in larger sizes would be very bad practice. Mr. Denny assumes that all "quick-make" switches have this inherent defect. We would like to mention that we, some time ago, placed on the market a switch which combines both the "independent make" and the "positive make."

It has so far only been made in one pattern, which is suitable for fires, &c. We now have many thousands in everyday use and they have proved most successful. We should be very pleased to send Mr. Denny a sample of this switch, should he wish to see one.

Summing up—it seems to us that the "independent make" is very desirable for the larger-size switches, particularly those in domestic use (such as radiator control switches, fire switches, &c.). At the same time, dependence should not be placed upon the spring alone for driving the contact blades home. It is essential that these be positively forced into the contacts, quite apart from the action of the spring.

C. L. Arnold.

London,
February 27th, 1922.

Your correspondent, Mr. C. W. Denny, is too sweeping in his statements, when he says: "the contacts on the blades of switch must be exceedingly light and necessarily weak to enable the small spring as used in the toggle mechanism to rapidly withdraw the contacts when breaking, and rapidly insert the contacts when making." Such criticism applies only to an automatic fly-off mechanism.

Mr. Denny may have had trouble with some form of "quick-make" switch, but need not set out to damn each and every design. I have to plead guilty to being the originator of quick-make switches, and of these have sold quite a large quantity; incidentally, too, I introduced the method of mounting switches on rods insulated with mica tube.

The spring of any switch should not be called on to extend more than 15 per cent. of its length; if, as in some cases, a spring is stretched to double its length, its life cannot be long, and such a design of switch would necessitate the light or unsatisfactory contacts of which your correspondent writes. In order to satisfy you, Mr. Editor, I am posting samples of my registered "U" clip, such as we use on all our "quick-make" switches; probably you will admit it to be the most satisfactory clip you have seen, and one not at all likely to work loose. If Mr. Denny had to open-circuit on, say, a three-pole 500-amp. switch, he would not again write of the "small spring used to withdraw": as a matter of fact, the spring does not do any work until the human element has almost withdrawn the blade, then the spring finishes the movement much more quickly than the hand can. As to the making, well, we have no trouble in obtaining a spring movement which assures complete and full contact.

In the middle of the present month we received from a Liverpool client an order for "spare clips"; we at once wrote asking what work the switches (50-amp. single-pole I.C.) were doing, for we do not like orders for spare parts; we do not even list them. Our client wrote us: "On some days the switches operate more than a thousand times in the day, and the replacements are due to wear and tear." I'm enclosing the actual letter for the Editor's perusal. It is an unsought testimonial as to the advantages of "quick make."

I cannot imagine any sane person arguing that, provided the contact be sufficiently good, a slow make is as satisfactory as a quick make.

I know of one much advertised "quick make and break" switch which has neither the one nor the other; if any part be quick, it is just the very middle of the movement and when the blade is not near to the contacts; that switch ought to suit your correspondent.

H. W. Cox,
The Cantic Switch Co., Ltd.

Nottingham,
February 17th, 1922.

[The sample clips are certainly excellent.—Eds., Elec. Rev.]

The "Leader" Cable.

The letter of Mr. Edward Raymond-Barker in your issue of February 24th recalls his epoch-making experiments of 1905-1906 with his two-tone transmitter. In the minds of those who remember those researches, there can be no doubt of the importance of the advance he made towards achieving inductive signalling through submarine cables. So far as can be remembered, the first account of this work of his appeared in *The Times Engineering Supplement* in January, 1906. On January 24th, 1906, Mr. Raymond-Barker wrote a letter to that journal, giving some details of his results. It was followed by one from Mr. Edward Stallibrass relating to signalling over land-lines with the Cardew vibrating transmitter. The correspondence arose from an earlier reference to Signor Magini's experiments on vibratory transmission.

If the history of the development during the war of inductive signalling to give direction to vessels is ever written, we may find that Germany was the first to use a submarine cable for this purpose, and that the Admiralty captured the notion from the enemy, and subsequently adopted it. In any case, it will be well to suspend judgment upon war-use of a "Leader" cable until evidence is available from both sides of the North Sea.

Mr. Raymond-Barker refers to a curious coincidence with respect to the "Leader" cable and Havre. A still more curious coincidence is that side by side with his letter in the *Supplement* of January 24th, 1906, is a long review of a book by one Leader.

Rollo Appleyard.

London,
February 27th, 1922.

Proposed Emigration—New Zealand.

In the issue of the Electrical Review, dated February 24th, I notice a very glowing account of New Zealand, and according to Mr. Allan it may in time rival this country as a manufacturing centre. I am afraid, owing to my antiquity (40), the future of New Zealand does not interest me, and I would prefer concrete information as regards present-day prospects for, say, administrative engineers.

A man of the "assistant engineer" category must obtain a remunerative position first before he can appreciate the beauties of any country.

I do not know exactly what is meant by a "skilled electric worker." I am, of course, a jolly hard worker, but could not call myself a skilled artisan, and if the latter is intended I may as well delete New Zealand as a possible home.

Mechanical Engineer.

London,
February 27th, 1922.

The Jubilee of the Institution of Electrical Engineers.

Those of us who think, those of us who have ambition, must have felt very fully the pleasure of the opportunity for hero-worship which the Jubilee of the Institution of Electrical Engineers afforded. The innate desire to hero-worship is to some degree developed in us all, and yesterday we were actually walking with, talking to, and touching the giants of the past. We were called to their feast to gather the crumbs which their loaded board dropped, to listen to the telling of their feats, to hear the roar of their voices. We pigmies quaked at their every movement, and wondered if we were capable of even brushing, let alone wearing, their mantles which will fall upon us. What perhaps struck one more than anything else was the glorious freedom with which the giants could be approached. There was no "Fe, Fi, Fo, Fum" about them at all; they were just themselves.

Our Institution should indeed be proud and glad of this great freedom which more than ever emphasises the remark of one of the greatest giants—Colonel Crompton—that in the old days it was the team work to which they owed their success. Going home along the Embankment, I heard the following remark made by one of two men in front of me: "What a great thing it is," he said, "that at the Institution of Electrical Engineers the greatest even of the great men who have made it what it is, who have made the industry what it is, can be approached, and spoken to by the humblest member." This is indeed a great thing, and we

can only hope that as the Institution grows, as it is now growing, this great feeling of fellowship, this great freedom from all "side" or conceit will for ever remain. It is the keynote of the success of the Institution.

C. Mancha Bennett.

Wood Lane Works,
February 27th, 1922.

All members of our Institution are feeling very proud just now; our 50 years' celebration, with its most interesting features, our 10,000 membership roll, and our Royal Charter, certainly entitle us to swell with pride, but still, let us never be content whilst there are possibilities of improvement.

On this ground I venture to express the opinion that it is regrettable, now we are again in possession of our Embankment House, that we find the illumination of the lecture hall open to severe criticism.

When the lighting was originally installed, under the advice of Messrs. Handcock & Dykes, conditions were different; the half-watt (inert gasfilled) lamp had not arrived at a commercial stage, and the Illuminating Engineering Society, founded by our greatly-esteemed past-president, Dr. Silvanus Thompson ("the Doctor"), was still unborn.

The intense illumination of the white coves and the very dull appearance of the matt-surfaced panelling make the hall unpleasant to be in after dark.

The illumination of our building, seeing that so many of our members are professionally interested in electric lighting, should be a lesson in good electric illumination, both to members and to visitors.

The illumination of the hall of the Society of Arts must be revised when that Society rebuilds, as it shortly will, its famous home; the lecture hall of the Royal Institution possesses no dimmers. Let us hope the managers of neither Society will come to our lecture hall for inspiration for improvement.

Funds are not lacking for improvement in illumination methods in our really fine home, and I suggest the immediate formation of a small committee of illumination experts, empowered to investigate and charged to make recommendations to our Council in sufficient time for the alterations to be made before next autumn.

Justus Eck, M.I.E.E.

London,
February 25th, 1922.

Automatic Telephone Exchanges.

With your permission, we should like to reply to the letter on "Automatic Telephone Exchanges," which appears in your issue of February 24th.

Mr. Garbett cannot have read the description of our installation very carefully, or he would have noticed the feature which makes the system unique (your editorial foot-note makes clear this point).

The installation of automatic telephones for purely inter-departmental work is not new in the newspaper world. We think we are right in saying that several offices were equipped with such systems prior to October, 1919.

Mr. Garbett says he is "not aware that the connection of the automatic to the Post Office Exchange is the boon that it would at first appear." Well, sirs, we use the connection, and are quite sure that the benefit is very great.

Before deciding to adopt the system, we made careful observation of the traffic conditions on our G.P.O. and inter-communication lines, and made provision for allowing important members of the staff to have external and internal telephone facilities, at one and the same time, by providing two instruments in these cases. This prevents any loss of time in heads of departments communicating with subordinates, when external calls make this necessary, time being as valuable in this office, as in the office in which Mr. Garbett is employed.

Robt. A. Lambert,
Works Superintendent,
for C. T. Tinling & Co., Ltd.

Liverpool,
February 27th, 1922.

BUSINESS NOTES.

Bankruptcy Proceedings.—Charles Godolphin Bennett, engineer and agent, 66, Mark Lane, E.C.—This debtor attended on February 22nd before Mr. Registrar Hope at the London Bankruptcy Court for public examination upon accounts showing total liabilities £2,133 and a deficiency of £1,174. In the course of his evidence, the debtor stated that in March, 1916, he was approached by a gentleman in relation to electrical businesses, and particularly the manufacture of switch holders. The gentleman was experimenting in those articles, and wanted witness to finance him. Accordingly he looked into the matter, and eventually spent £2,000 in experimenting and in part payment of some 50 gross of switches which he ordered to be manufactured. In order to complete the payment for them he again approached his brother (who had previously financed him), but the latter, owing to losses made in Russia, could not give him further assistance, and eventually these bankruptcy proceedings were instituted by a creditor. All the orders for the switches were placed by witness, and there was now owing £620 to various firms who supplied them. The Official Receiver asked the debtor how he came to be interested in this business seeing that he was not an electrical engineer. The witness: No, but I know more about it than a good many electrical engineers. Debtor stated in reply to further questions that his creditors had accepted an offer of a composition of 7s. 6d. in the £, and the Court would in due course be asked to approve the arrangement. The examination was concluded.

Arthur Courtenay Ince, trading as the Newcastle Electrical Engineering Co., lately trading in partnership with another person as the Tyne Electrical Industries, 21, Fenkle Street, Newcastle-on-Tyne, electrical contractor.—The first meeting of creditors was held on February 22nd at Newcastle-on-Tyne. The statement of affairs showed liabilities of £413, against assets of £170. The Official Receiver stated that there were several matters to be inquired into, and he suggested that they should remain over until debtor's public examination on the following day. He proposed to ask for an adjournment of the examination. The creditors decided to adopt this course.

Thomas Scott and James Campbell, trading as T. Scott and Co., 42, Handyside's Arcade, Percy Street, Newcastle-on-Tyne, wholesale electrical suppliers.—The first meeting of creditors was held on February 21st at the Official Receiver's Office, 4, Northumberland Street, Newcastle-on-Tyne. It appeared that debtors commenced business in March, 1920, with £260 capital, each debtor providing £50, while £160 was borrowed. Campbell managed the business, while Scott, who was in a situation, assisted with the book-keeping. The statement of affairs showed liabilities of £1,179, while the assets were estimated to realise £402, or a deficiency of £776. In August last a writ for £66 was served on debtors, and paid; in December executions for £73, £20 and £10 were levied and paid. A further execution levied on January 27th last was the immediate cause of failure. Books of account were kept. The creditors decided to appoint Mr. Wm. Brittain, I.A., of 15, Pilgrim Street, Newcastle-on-Tyne, as trustee, with a committee of inspection. The following are creditors:—

	£		£
B.T.T. Electric Lamp Co. ...	55	Gledson, J., & Co.	255
Campbell, T.	120	Jeary Electric Co., Ltd.	16
Campbell, J. W.	50	Lee, A., & Co.	24
Collins, L.	40	North of England Engineering &	
Collins, W.	50	Electrical Manufacturing Co.	13
City Electric Co.	192	Metropolitan-Vickers Electric Co.,	
Fuller's United Electric Works,		Ltd.	24
Ltd.	39	Stella Lamp Co., Ltd.	38
Foster Engineering Co.	28	Stentophone Co.	24
Favell, J. E., & Co.	40	Rodgers, —.	30
General Electric Co.	49	Liddell, —.	20

The public examination of these debtors was held on February 23rd at the County Court, Newcastle-on-Tyne. Questioned by the Official Receiver, debtor Campbell said he was in the Army between September, 1914, and June, 1919, when he returned to his situation as an electrical engineer until March, 1920. He was then joined by Scott, and they traded at their present address as wholesale electrical suppliers. They became aware of their position about July, 1921, but continued trading in the hope that business would improve. The examination was adjourned to be closed.

W. H. S. Ward, electrical engineer, 56, High Street, Acton.—Trustee (Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C.) released February 2nd, 1922.

W. Bennett, electrical contractor, Back Sitwell Street, Derby.—Last day for proofs for dividend, March 17th. Trustee: Mr. E. W. Humphreys, Official Receiver, 4, Castle Place, Nottingham.

A. T. Williams and W. J. Bevan (Electrical and General Engineering Co.), electrical engineers, 49, Commercial Street, Aberdare.—Receiving order made February 21st on creditors' petition.

R. C. Jones (Elect Ma Engineering Co.), 10, Caledonia Street, King's Cross, W.C.—Trustee (Mr. D. Williams, Official Receiver, Carey Street, W.C.) released January 23rd, 1922.

T. Davison (Radio Technical College), 30, Falkner Street, Liverpool.—First meeting March 3rd, at the Official Receiver's office, Liverpool; public examination, March 13th, at the Court House, Liverpool.

R. H. Liddell (Liddell & McInnes), electrical engineer, 4, The Crescent, Carlisle.—Receiving order made February 21st on debtor's own petition.

A. Lord, electrical contractor, 33, Westgate, Burnley.—Trustee (Mr. C. H. Plant, 13, Winckley Street, Preston) released January 30th, 1922.

W. Hedgecox, electrical engineer, 121, Salop Street, Wolverhampton.—Trustee (Mr. S. W. Page), 30, Lichfield Street, Wolverhampton) released January 30th, 1922.

Company Liquidations.—Oldham, Ashton & Hyde Electric Tramway Co., Ltd.—According to the financial Press, a final distribution of 6s. 7½d. per share is about to be made in respect of the surplus assets.

Electrical & Engineering Development, Ltd.—Meeting March 24th, at 1-3, Shelgate Road, Battersea, S.W., to hear an account of the winding-up from the liquidator, Mr. D. J. Longden.

Stoneycroft Electrical Works, Ltd.—Meeting March 27th, at 26, North John Street, Liverpool, to hear an account of the winding-up from the liquidator, Mr. E. Chetter.

Wakelins, Ltd.—Winding up voluntarily. Liquidator: Mr. P. J. Goodchild, 16, Tokenhouse Yard, E.C. Meeting of creditors, March 8th, at 7, Tottenham Street, Tottenham Court Road, W.1.

Cascoll Engineering Co., Ltd.—Winding up voluntarily. Liquidator: Mr. H. F. White.

Alby United Carbide Factories, Ltd.—A petition for the winding up has been presented by the company to the High Court, and will be heard in London on March 7th.

Dissolution of Partnership.—Skidmore Bros. & Co., electrical engineers and contractors, Wombwell, Barnsley.—This partnership has been dissolved. Debts will be attended to by Messrs. O. & J. H. Skidmore, who will continue the business under the same style and at the same address.

Private Arrangement.—Grover, Smith & Willis, electrical and mechanical engineers, Sarum Hill, Basingstoke.—A circular has been issued in this matter stating that a conference of the larger trade creditors has been held, when it was stated that an offer might be forthcoming for the business at a figure sufficient to satisfy the claims of the creditors in full, the assets being £2,765, subject to realisation, and the liabilities £2,694. The circular further stated: "Unfortunately this offer has not been obtained, and at such conference it was resolved that in that event the debtors should execute a deed of assignment to Mr. E. H. Hawkins (Messrs. Poppleton, Appleby and Hawkins) as trustee, together with a committee of inspection consisting of three of the principal creditors—Brown Bros., Ltd., United States Rubber Co., and W. & A. Bates—and in accordance with such resolution the debtors have now assigned their estate to the trustee."

Meeting of Creditors.—Lawford, Ross & White, electrical engineers, Glasgow.—At the meeting of creditors held on February 24th a small committee was appointed, and it was decided that final consideration of matters should be deferred for a week.

Trade Announcements.—Messrs. Reavell & Co., Ltd., have removed their London office to larger premises at 47, Victoria Street, S.W. Telephone number unaltered (5935 Victoria). Their head office remains at Ranelagh Works, Ipswich.

Mr. H. E. Smith has commenced business as an electrical engineer and contractor at 186, Lake Road, Portsmouth, and desires to receive catalogues of electrical goods.

In our "New Companies Registered" section to-day we give particulars of the Foundation Co., Ltd., which, we understand, has been formed to carry out contracts for complete construction and equipment of public works, railway electrification schemes, generating stations, industrial buildings, &c. The capital is being privately subscribed in this country, and the management staff consists of men who have been associated with many important public works contracts in the United Kingdom and abroad. The company will also have at its disposal the accumulated experience of the Foundation Co., of New York, and its subsidiary companies, the Foundation Co., Ltd., of Canada, and Foundations, Constructions Travaux Publics in France. The registered offices are at Windsor House, Kingsway, W.C.2, and the directors are: Mr. A. W. Tait, C.B.E. (chairman), Col. Fred. W. Abbot, Sir Charles Davidson, Mr. John W. Coty, Mr. Franklin Remington, and Mr. Walter Rutherford; secretary, Mr. R. Brigge.

Several weeks ago the Electric & Railway Finance Corporation, Ltd., was formed with a capital of £500,000 to carry out important electrical developments at home and abroad. Mr. F. Dudley Docker and Sir E. E. Pearson were among the directors, and the offices are at 4, Central Buildings, Westminster, S.W.

Catalogues and Lists.—Messrs. Jeffcock & Parsons, Ltd., 180, Piccadilly, W.1.—An illustrated booklet, "The Science of Oil Filtration," dealing with Fox's oil filter, storage tank, and water separator.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet V 2720, giving prices and illustrations of numerous "Witton-Kramer" portable electric tools, grinders, drills, &c. Leaflet L 2713, giving revised catalogue prices of "Witton" primary cells.

Messrs. Fleming, Birkby & Goodall, Ltd., Liversedge, Yorks.—A card advertising "Elo" insulating varnish.

B.K.B. Electric Motors, Ltd., Finsbury Court, Finsbury Pavement, E.C.2.—An illustrated descriptive catalogue of d.c. motors of small sizes. Priced.

Messrs. Francis Chapman, Sons & Deekes, 47-53, Albion House, 59, New Oxford Street, W.C.1.—Two leaflets illustrating and describing the "Jackson" patent tilting stool for shops or factories.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—A new show-card, 12 in. by 19 in., advertising Jackson electric cookers.

Messrs. J. A. Crabtree & Co., Ltd., Rushall Street, Walsall.—Catalogue of electrical accessories, particularly quick-make and quick-break tumbler-switches, from 3 to 15 amperes, in a variety of patterns and finishes, special switches, bell pushes, switch-sockets, switch plates, watertight switches, plugs, and sockets, &c. Illustrated and priced.

Mr. Leslie M. Michael, Providence Place, Kilburn, London, N.W.6.—Illustrated price list of wireless apparatus.

The Cable Accessories Co., Ltd., Britannia Works, Tividale, Tipton.—Fine and comprehensive catalogue of 144 pages (No. 11), containing illustrations and prices of a large variety of "Revo" electrical specialities, including electric lighting fittings for industrial and commercial purposes (e.i. watertight fittings, mining and industrial fittings, cluster fittings, street lighting brackets, ships' fittings, and accessorial parts, &c.). The company's heating, switchgear, and fan manufactures are now dealt with in separate lists, owing to the growth of these departments.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries:—

Ray-B-Uld (lettering and design). No. 418,703. Class 13. Gas and electric fittings (brass). Arthur Raybould, 5-11, Fleet Street Parade, Birmingham. September 21st, 1921.

Silvertown. No. 412,793. Class 6. Shunt-wound motors and dynamos. February 23rd, 1921. No. 417,065. Class 8. Electric cables and conductors. July 19th, 1921. The India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., 106, Cannon Street, London, E.C.

Varta. No. 416,107. Class 8. Electric accumulators, batteries, and parts. Accumulatoren Fabrik Gesellschaft, 3, Askanische Platz, Berlin, S.W.11. Germany. June 13th, 1921.

Ora. No. 421,297. Class 8. Thermionic valves. The Mullard Radio Valve Co., Ltd., 35a, Claybrook Road, Hammersmith, W. December 7th, 1921.

Amplokon (lettering and design). No. 420,523. Class 13. A spark-gap device or intensifier for use with sparking plugs of explosion engines. E. H. Cardwell, 36, Shaftesbury Avenue, London, W.C. November 14th, 1921.

Sphinx. No. 418,392. Class 16. Insulating compositions of porcelain and earthenware. The Sphinx Manufacturing Co., Ltd., 240-2, Bradford Street, Birmingham. September 28th, 1921.

Befortyn. No. 421,461. Class 18. Electric bell systems. The Jeary Electrical Co., Ltd., 8, Lambeth Hill, Queen Victoria Street, London, E.C. December 13th, 1921.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, February 28th: Copper (electrolytic) bars, £65, 70s. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £75, £10 10s. dec.; ditto ditto h.c. wire, 10d., ½d. dec.; Silicium bronze wire, 1s. 2d., ½d. dec.

Messrs. James & Shakespeare report, March 1st: Copper bars (best selected), sheet and rods, no change; English pig lead, £21 15s., 15s. inc.

Flood Lighting.—We have received from the General Electric Co., Ltd., a copy of booklet I.E. 2,695, on "G.E.C. Floodlights," showing the application of the system to Messrs. Selfridge's premises, which we recently illustrated, and to Magnet House itself. The services of the Illuminating Engineering Department of the company are at the disposal of engineers and contractors for the purpose of designing similar schemes, and copies of the booklet can be had on application.

Australian Trade Openings.—It is expected that large orders for telegraph and telephone equipment will be placed by the Australian Commonwealth Postmaster-General during the next few years. There is talk of a loan of 9½ million pounds for general developments of this description, and British manufacturers are being urged to watch the situation closely.

A Works Visit.—On February 18th a party of members of the Association of Engineers-in-Charge visited the Benjamin Electric, Ltd.'s, works at Tottenham, where the firm's manufactures and methods were inspected. The party numbered over 30, and in addition to an explanatory tour of the works, a short lantern lecture was given on "Industrial Illumination," which was much appreciated.

Strike at Mayence.—About 13,000 electricians and metal-workers have gone on strike at Mayence. The strike of Alsatian metal-workers and electricians in Mulhouse, Guebwiller, and Turckheim continues.—*Times*, February 24th.

Wagon for Electrical Machinery.—There has just been completed by the North-Eastern Railway Co. at its wagon works at York a new 70-ton bogie trolley wagon specially designed for the conveyance of large pieces of electrical machinery. This wagon is 57 ft. 6 in. long, the wheel base of each bogie is 12 ft., and the wagon is 8 ft. 10 in. wide. Its weight is nearly 39 tons.

Book Notices.—*The Municipal Year Book* for 1922. London: The Municipal Journal, Ltd. 15s. net.—This volume, as usual, contains a vast amount of information respecting municipal undertakings and interests. The principal features of the last edition have been retained and additional information respecting population, rateable value, area, and rates levied in the various administrative counties is given. Financial results of electricity, tramway, gas, water, and other undertakings are included. There are in all nineteen sections, one of which concerns itself with tramway legislation and accounts, and another with electricity supply legislation, dates of transfer of orders to companies, undertakings purchased by municipalities, dates of the different Electric Power Supply Acts, and annual returns of a large number of undertakings.

"A.C.E.C. Bulletin," No. 93, January, 1922 (19 pp.).—Owing to the occupation of Belgium by the Germans in 1914, the Ateliers de Constructions Electriques de Charleroi was compelled to suspend the publication of its "Bulletin." The introduction to this issue states that now reconstruction has been practically effected an attempt will be made to regain lost time. The articles in the present number include "The A.C.E.C. Before, During, and After the War"; "The Advantages of the Electric Motor over the Steam Engine"; "Characteristics Which Must be Possessed by Rolling-mill Motors"; "Power-factor Correction by Static Condensers," &c.

"*Journal* of the Institution of Electrical Engineers." Vol. LX. No. 306. February, 1922. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—The following papers are published in this issue:—"Induction-type Synchronous Motors," by Mr. L. H. A. Carr; "Some Notes on the Design of Liquid Rheostats," by Mr. W. Wilson; "The Effect of Heat on the Electric Strength of Insulating Materials," by Mr. W. S. Flight; and "High-speed Telegraphy," by Lt.-Col. A. G. T. Cusins.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLI. February, 1922. No. 2. New York: The Institute. $1.

The March issue of the Official Journal of the Institute of Cost and Works Accountants, *The Cost Accountant*, will be a special number, containing a full report of the Costing Conference held under the chairmanship of the Right Hon. Lord Weir of Eastwood.

"Principles of Alternating Currents," by R. R. Lawrence. Pp. xiv+432; 121 figs. 20s. net; "Protective Relays," by V. H. Todd, pp. xii+274; 244 figs. 12s. 6d. net. London; McGraw Hill Publishing Co., Ltd.

"Kinematograph Studio Technique," by L. C. MacBean. Pp. viii+112. 44 figs. London: Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net.

"Discussion on the Structure of Molecules" (5 pp.). London: The British Association for the Advancement of Science. Price 9d. net.—This is the second of a series of reprints of communications given at the Edinburgh meeting of the Association last year.

"*The English Electric Journal*, Vol. II, No. 1, January, 1922.—This issue contains a long, well-illustrated description of the Blackburn (East)) power station; and articles on "Camshaft Control" and "Turbo-Blowers."

"The *Practical Engineer* Electrical Pocket Book and Diary, 1922" (610 pp.). London: The Technical Publishing Co., Ltd. Price 2s. net.—Numerous additions and amplifications have been made in the latest issue of this useful work. The section dealing with electric traction has been re-cast and brought up to date; the part treating of wireless telegraphy and telephony has been added to and revised; and the section on power factor meters, synchronisers and frequency meters has been similarly treated.

Messrs. Benn Bros., Ltd., announce that Oliver Heaviside's work on "Electromagnetic Theory," which has been unprocurable in a complete form for some time, is now being reprinted in a small edition of 250 copies.

New Belgian Companies.—Accumulateurs "Eide" R. and A. Desbeck & Co. is the style of a new company formed at 49, Rue de Lalaing, Brussels.

Under the style of Sevrin, Doumont et Claisse has been formed at Namur, a company for the sale of all kinds of electric material.

Godefroid Michaïloff et Cie. have been embodied a company at Brussels (34, Rue d'Argent) for the trade in electrical supplies and eventually their manufacture and installation.

With a capital of 100,000 fr., Les Entreprises Electriques du Sud de la Belgique has been established at Brussels (114, Rue des Goujons) for the purchase, sale and installation of all kinds of electric material.

Verschueren et Devoye has been constituted at Brussels for wholesale trading in electric material.

Lemaire Frères is the style of a company formed at Verviers (29, Rue Bidan) to undertake electric construction works and for trading in electric material.

Brazilian Centenary Exhibition.—The Department of Overseas Trade has sent us an advance copy of the prospectus for the British section of the above international exhibition. This contains a plan of the buildings to be occupied by this section; particulars of charges for space; a note regarding a freight concession for exhibits; and a space-application form. Applications must reach the D.O.T. before March 10th. It is stated that there is an urgent need for participation by British firms, as the United States, France, Belgium and other trade rivals are making active preparations.

The Osram-G.E.C. Staff Dinner.—On February 24th the annual dinner of the staff of the Osram-G.E.C. Lamp Works, Hammersmith, was held at the Café Royal, Regent Street. The attendance was a large one, and the arrangements throughout were excellent. Mr. C. Wilson occupied the chair, and after proposing the loyal toast, warned succeeding speakers that lengthy orations were prohibited. In a few words, Mr. C. F. Proctor proposed the toast of "The Firm," saying that "the firm" was not the directors, or the management, but all of them. He spoke of the good relations existing between everybody at the works. Mr. S. D. White replied, after reading a message of regret from Mr. Hugo Hirst that illness forced him to stay away from the dinner. Mr. White said that throughout the works there was splendid team work, and everywhere whole-hearted service. He remembered the time when the sales organisation was crying out for lamps, but now owing to the slump the works were well ahead of the selling side—he hoped their positions would soon be reversed. The Chairman then proposed the health of "The Visitors and the Press." He said that most of the guests were members of the sales organisation, without whom the firm could not exist. With that part of the toast he coupled the name of his old friend Mr. M. Solomon. He said the Press had been a very good friend to the firm, and participated in all their functions; he made special reference to Mr. Rentell and the firm's last "outing." Mr. Solomon responded to the first part of the toast, saying that he was glad of his early training at the works, and considered himself a member of the staff still, but loaned to the G.E.C. for a time. Mr. S. Rentell replied for the Press. He remembered the commencement of the Robertson works, and he had attended many of the staff's annual dinners. Every year the number present was larger, and he hoped that the growth would continue. In proposing the toast of "The Chairman," Mr. L. D. Goldsmith said that they all must realise how much the lamp works *was* Mr. Wilson. He had been designated as the sun round which the "Osram" world revolved. Mr. Wilson, replying, expressed his thanks, and announced that he was an optimist. He believed that the present depression would soon pass away and things would improve. He said that thanks were due to Mr. Adams and his assistants for the splendid way in which the function had been arranged. A vote of thanks was accorded Mr. Adams (who said that Messrs. Gosling and Vanhisburgh were equally entitled to it), and the three gentlemen replied briefly. An excellent concert was given by Messrs. H. Anderson, H. Speller, J. Richards, G. O'Hagon, Prof. Beresford, and Miss V. Stevens. Miss Kathleen Desmond acted as accompanist.

For Sale.—By direction of the Disposal Board, Messrs. Hall, Wateridge & Owen, Ltd., will sell by auction, at the Monkmoor Aerodrome, near Shrewsbury, machinery and plant, electrical equipment and stores. (See our advertisement pages to-day.)

Germany and Russian Trade.—In a recent speech at Manchester, Mr. Stanley Baldwin, President of the Board of Trade, referred to the slight signs of a trade revival, and he added the opinion that England was never in a better position to compete with the world on fair terms, its reputation was never better, and its prestige was never higher. The economic reconstruction of Europe was essential to a trade revival, and they must be prepared to face the fact of Germany once more being a formidable competitor. He said that Russia had never been a great market for our goods, and ventured the view, with which we may not all readily agree, that she never would be. In Mr. Baldwin's opinion we must be prepared to see Germany getting the lion's share of trade in Central and Eastern Europe. Britain's natural development lay in the Dominions, the East and South America. Of course, we can do little electrically in Russia at present, and Germany may be, for various reasons, particularly favourably placed for catering for Russia's earlier electrification requirements, but Mr. Baldwin's official generalisation is not likely to induce British engineering and electrical exporters to banish Russian possibilities from their minds.

British Representatives in South Africa.—The report of the British Manufacturers' Representatives' Association of South Africa (Inc.) for 1921 states that the Association has had a very successful year despite the fact that trade conditions had only begun to improve in the late months of the year. There is a net increase of 45 in the membership, which is now 401. The honorary members number a further 160. Additional members are wanted from representatives in South Africa, and honorary members from among manufacturers at home whose support (annual subscription one guinea) is greatly desired. The report contains particulars of a large number of matters that have been handled by the Council of the Association during the year. Communications should be addressed: P.O. Box 845, Cape Town.

Industrial Unemployment Insurance.—The Ministry of Labour draws the attention of employers and trade unions to the suggestion made by the "Geddes Committee" that out-of-work insurance administration might be carried out by each industry. A letter has been sent to the two parties asking them to consider methods of dealing with unemployment in their own trades. In the meantime, leaders of industry are asked for suggestions for improving the present insurance arrangements.

Miners' Lamps.—Memorandum No. 6 of the Miners' Lamps Committee (H.M. Stationery Office, price 9d. net) is a "Report on Lamp-room Organisation and the Upkeep of Safety Lamps." The Committee considers that the improvement in lamp-room organisation has not kept pace with the advance of the safety lamp. Suggestions are therefore put forward for the better management and equipment of lamp-rooms. Owing to the presence of acid fumes from the accumulators of electric lamps, separate rooms for these lamps and the flame types are recommended. Electric-lamp rooms should be fire-proof, as the Committee considers that the likelihood of fire is greater than with the flame type owing to the possibility of short-circuits in the power supply. Mr. Spray, representing the Association of Mining Electrical Engineers, was examined with regard to the design of arrangements for the care and maintenance of electric lamps, and an extract from the *verbatim* report of proceedings is given. The *status* of the lamp-room staff, it is considered, should be raised, and examinations as to fitness for the occupation should be made. Other points dealt with include the hire-maintenance system (which is considered unsatisfactory in some respects), inspection and tests, distribution and checking of lamps, &c.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

London.—May 1st to 6th, Photographic Fair; July 3rd to 14th, London Fair and Market.

Birmingham.—May 25th to June 3rd, Industrial and Commercial Efficiency Exhibition; June 15th to 24th, International Foundry Trades Exhibition.

Belgium (*Liége*).—June and July, International Technical Engineering Exhibition.

Brazil (*Rio de Janeiro*).—September 7th to November 15th, Centenary Exhibition.

Esthonia (*Reval*).—September 2nd to 11th, Agricultural and Industrial Exhibition.

France (*Paris*).—April, Heating Apparatus Exhibition; May 10th to 25th, Sample Fair.

Norway (*Christiania*).—April 22nd to May 7th, Electrical Exhibition.

Switzerland (*Basle*).—April 22nd to May 2nd, Sample Fair.

Trieste.—May, International Sample Fair.

Submarine Accumulator Containers.—The Lorival Manufacturing Co. (1921), Ltd., has secured a substantial contract from the British Admiralty for the supply of submarine accumulator containers. We understand that hitherto the supply of these articles has been, more or less, a foreign monopoly, but there is no need for Government contracts to be placed abroad, when English firms are capable of doing the work.

Unemployment.—During the week ended February 14th there was a reduction of about 4,000 in the number of registered unemployed, the total being 1,443,000. A reduction was also apparent in the number of persons on short time claiming unemployment benefit.

LIGHTING AND POWER NOTES.

Australia.—New South Wales.—In connection with the work which is being carried out at the Railway Commissioners' Colliery, at Mort's Gulley, a large generating station is to be erected, which will provide electricity for the various railway centres and the towns *en route*.

Tasmania.—It is stated that during the last financial year a sum of £950,000 was spent upon the hydro-electric scheme, which has now cost £3,000,000. Parliament has voted another £800,000 for the completion of the work, which will make available 57,000 h.p.—*Reuter's Trade Service* (Melbourne).

Barry.—Electricity Supply Scheme.—The Town Council has received a report from its consulting engineers, who recommend that the scheme for a supply of electricity to the district be proceeded with. The estimated cost of the scheme is £20,000.

Batley.—Year's Working.—The annual report on the electricity undertaking for the year ended March 31st, 1921, shows a profit of £1,944.

Birmingham.—Extensions.—The electricity department has a scheme in hand for the extension of its service in the east and south sides of the city. It is proposed to run a high-pressure main through various surrounding districts and to erect transformer stations. The cost is estimated at £100,000.

Bridlington.—Year's Working.—The annual report of the electricity undertaking shows a net profit of £226.

Canada.—Development of the St. Lawrence.—The Quebec Government has joined the body of active opponents to the project for joint development of the St. Lawrence River above Montreal by Canada and the United States for navigation and power development purposes. The scheme has been endorsed by an International Joint Commission as a means of opening the Great Lakes to ocean traffic, but the suspicion finds frequent expression in the Press that the development is really for commercial interests in the United States.—*Morning Post.*

Cardiff.—Year's Working.—The annual report of the city electricity department (engineer: Mr. C. G. Morley New), for the year ended March 31st, 1921, shows a total income of £160,897, as compared with £117,626 in the previous year. Working expenses amounted to £109,108 (£76,355) leaving a gross profit of £51,788 (£41,271). After payment of interest, loan charges, &c., there was a net surplus of £23,711. The result of the previous year's working was a net profit of £18,581.

Ceylon.—Hydro-Electric Scheme.—Steps are being taken by the Government to secure the Hardenhuish Valley, near Watawala, 20 acres in extent, which will be utilised as a reservoir for hydro-electric purposes. The Government has also approved of the Aberdeen-Laxapanagalla scheme, in which two streams will flow into the Hardenhuish Valley, providing sufficient power for the generation of 200,000 h.p. of electricity.

Chasetown.—Electricity in Bulk.—The Cannock Chase Colliery Co., Ltd., has intimated to the local Council that it is prepared to supply electricity in bulk to Chasetown, Chase Terrace, and Loney Hay, in the event of the local gas company's not being able to carry out a scheme.

Continental.—Spain.—A concession has been granted for the establishment of a plant to utilise the water-power of the Riofrio, near Loja, Province of Granada, for generating electrical energy for lighting and power purposes.

Cookham.—Electricity Supply.—The Electricity Commissioners have sanctioned a scheme for a supply of electricity to the district, and arrangements are being made for putting the scheme into effect.

Croydon.—Loan Sanctioned.—The Electricity Committee has received sanction from the Electricity Commissioners to the borrowing of £31,405, in respect of the balance of the expenditure on the extension of the electricity works.

Dundee.—Grampian Scheme.—The Electricity Committee which recently sent a deputation to meet the promoters of the Grampian Hydro-Electric Power Co., has decided to continue negotiations with a view to a joint working arrangement being arrived at.

Electricity District.—East of Scotland.—The Electricity Commissioners have provisionally determined that the undermentioned area shall constitute a separate electricity district for the purposes of the Electricity (Supply) Act, 1919—that is to say, the county of the City of Edinburgh, the county of Midlothian, and the county of East Lothian; so much of the county of Linlithgow as is included in the Royal Burgh of South Queensferry and the parishes of Abercorn, Dalmeny, Ecclesmachan, Kirkliston (part of), and Uphall; and so much of the county of Peebles as is included in the parishes of Eddleston, Newlands, and West Linton. Objections or representations and schemes for improving the existing organisation for the supply of electricity within the district should reach the Electricity Commission not later than July 31st, 1922.

Harrogate.—Loan Sanctioned.—The Town Council has received sanction to a loan of £3,250 for mains.

London.—Poplar.—The Electricity Committee has recommended that the charges for electricity, which at present are 85 per cent. above pre-war rates for lighting and power, and 70 per cent. for private and domestic supplies, be reduced to 50 per cent. above pre-war rates.

Loughborough.—Extensions.—The Electricity Commissioners have sanctioned a loan of £147,500 for plant, buildings and mains, and the Town Council has instructed Mr. Wordingham to prepare a scheme for the installation of plant with a capacity of 6,000 kW.

Newark.—Bulk Supply.—An application has been received from the Town Clerk of Newark for a supply of electricity to the distributing station in Newark, by the Lincoln Corporation, which has replied that it is not prepared to give a supply.

Port Talbot.—Application for Order.—The Town Council is applying for a Special Order to supply electricity to the district.

Price Reductions.—Reductions in the charges for electricity are to be made in the following districts:—Dublin, Hebden Bridge, Kettering, and Rochdale.

Shrewsbury.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £2,000 for mains extensions in connection with the Town Council's application for £2,650, and state that they are prepared to consider the borrowing of a further amount when the actual cost of the extensions has been ascertained.

Skipton.—Loan Sanctioned.—The Urban Council has received the sanction of the Electricity Commissioners to the borrowing of £11,800 for mains, services, and meters.

South Wales.—Electrically-operated Collieries.—An electrical scheme involving the expenditure of over £1,000,000 has been commenced by Messrs. Cory Bros. The company is to electrify the three collieries in Ogmore Valley, and also

some of its pits in the Rhondda. The electrical energy, which is to be generated at Ogmore Vale, will be distributed to the various collieries by overhead cables. Transmission lines will run from Ogmore Valley through the mountains for a distance of about six miles.

Torquay.—Proposed Sub-station.—In connection with the agreement between the Town Council and the Newton Urban Council regarding an electrical scheme, it is proposed to erect a sub-station in Upton Valley, provided the sanction of the Town Council and the General Purposes Committee can be obtained.

Waterford.—Electricity Supply.—The Lighting Committee has recommended the appointment of Mr. J. McEntee, consulting engineer, to draw up a scheme for the supply of electricity to the district.

West Ham.—Electricity Supply.—A meeting of electricity consumers was convened by the Electricity Committee last Tuesday to consider the position of the electricity undertaking. In his report, the electrical engineer (Mr. F. W. Purse) stated that during the past few years the accounts of the department showed a deficit, which had been made up out of the rates. He stated that the present deficit was largely due to the recent miners' strike, which had restricted the output of the undertaking and raised the cost of coal. In 1919, to meet the increased demand for electricity, a 20,000-kW set, complete with boilers and accessories, was placed on order to replace the 5,000-kW set then in use, but owing to labour disputes long delay had occurred in the delivery of the plant. These circumstances had not warranted a reduction in the charges for electricity. The price of coal, however, had now been reduced by 40 per cent., and, with the prospect of the new plant shortly being in operation, he thought he was justified in recommending a reduction in the charges of 1d. per unit to ordinary consumers and 15 per cent. to consumers with special agreements for supply.

TRAMWAY AND RAILWAY NOTES.

Australia.—Victoria.—According to the *Railway Gazette*, the Victorian Railway Loan Application Bill, which has been passed by the Victorian Parliament, provides for a sum of £2,726,000 required for the year ending September 30th, 1922. Of this sum £1,000,000 will be expended on the electrification of the Melbourne suburban railways, including the electrical equipment. Rolling-stock, equipment, machinery, and other works will absorb £520,000; additions and improvements to permanent way and works, £640,000; installation of power signalling on the Melbourne suburban lines, £75,000; construction of new lines of railway, including rolling-stock, and work in connection therewith, and surveys of proposed lines, &c., £366,000. An item of £100,000 is provided for additions and extensions to shops, sidings, machinery, and other works, including fire protection, at Newport Workshops. In connection with the Melbourne suburban electrification, it is stated that £4,000,000 has been expended up to date, and that after the £1,000,000 now provided in the above Bill, a further £1,000,000 will complete the work. Up to the present about 75 miles of the total 98 route-miles to be electrified has been completed. Automatic sub-stations are to be used at several places on the outer suburban sections.

Continental.—Switzerland.—According to the *Financier*, the Federal Railway Administration has sanctioned the project of the electrification of the Lucerne to Basle railway line (*via* Olten), and a credit of 28,300,000 fr. has been opened for that purpose, whilst an agreement with the Bernese power works for the supply of power for the Scherzlingen-Berne line has been accepted with certain amendments.

Doncaster.—New Route.—The Corporation has received sanction from the Ministry of Transport to proceed with the construction of a loop tramway line above Trafford Street and Factory Lane.

Halifax.—Loan Sanctioned.—The Tramways Committee has received the sanction of the Ministry of Transport to the borrowing of £4,200 for the laying of a double tramway track in lieu of the existing single line on the Queensbury section of the tramways.

Newcastle.—Strike.—The tramway employés are on strike in consequence of the Corporation's decision to substitute a 48-hour for a 44-hour week.

Plymouth.—Year's Working.—The annual report of the Corporation tramway department shows a profit of £5,573.

South-Eastern & Chatham Railway.—Proposed Electrification.—Speaking at the annual general meeting of the South-Eastern Railway Company on February 23rd, Mr. Cosmo Bonsor said the company had lost its short-distance Metropolitan traffic, owing to the competition of tramcars and 'buses. It was therefore imperative to combat further encroachment upon its traffic by improving the services. This could only be done by electrification. The plans for electrifying the lines within a radius of 20 miles from London had to be postponed on account of the war, and Government control had so diminished railway credit that it was impossible to raise the capital for this most necessary undertaking. The company had therefore applied for State assistance under the Trade Facilities Act, and the application had been favourably received. It would be necessary to form a non-profit-making "constructive" company to carry out the work.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Wireless Service.—The Federal Parliamentary Wireless Committee has concluded taking evidence with regard to the proposed agreement with the Amalgamated Wireless Co. It is understood that some of the members of the Committee are reluctant to recommend an expenditure of £500,000 on a scheme which is largely experimental.—*Reuter's Trade Service* (Melbourne).

Former German Cables.—Washington Conference.—The International Conference to consider the allocation of the former German cables in the Atlantic was to meet at Washington on February 23rd. Representatives of Great Britain, the United States, France, Italy, and Japan were to attend. The Conference will determine the disposal of the three cables, two of which are operated by the French, and one by the British. It will also ratify the allocation of the ex-German cables in the Pacific according to the agreement, distributing them among Japan, the United States, and the Netherlands, reached at the recent Armament Conference at Washington.—*Reuter's Trade Service* (Washington).

Holland.—Wireless Telephony.—The Vazdia Press Agency at Amsterdam began its wireless telephone news service for the Dutch Press on February 21st. The service is carried out on the same lines as the Bankers' Wireless Telephone Service, which gives quotations for the Stock Exchange every day to about 400 stockbrokers in Holland.—*The Times.*

Italy.—Private Delivery of Telegrams.—The Italian Department of Posts and Telegraphs has decided to place the delivery of telegrams and parcel post packages in the hands of private enterprise. This department of the Government has been running at a tremendous loss, the expenses having quadrupled since 1913 and an ever-increasing deficit having been registered since 1918, says the *T. & T. Age.*

Switzerland.—New Marconi Co.—A Swiss Marconi Co., with a share capital of 1,800,000 fr. (Swiss), was formed at Berne on February 23rd. The Swiss Government has conferred on the Swiss Marconi Co. the exclusive right of conducting public wireless telegraph services between Switzerland and other countries. The Swiss Government itself becomes a shareholder in the new company; the majority of the shares are being subscribed by Marconi's Wireless Telegraph Co., Ltd., of London. The founders of the company include one influential Swiss group formed by the Agence Télégraphique Suisse, and a second Swiss group formed by the Swiss Bank Corporation of Basle and London. The tariff for wireless telegrams is to be exactly the same as that for wire telegrams, while special facilities are afforded for Press telegrams.

Maitre Truessel, of Berne, formerly presiding Judge of the High Court, has been elected chairman of the board of directors. M. Paul Usteri, member of the Upper House of the Swiss Federal Assembly, has been elected vice-chairman. Among other members of the board are: (1) M. Furrer, director-general of State Posts and Telegraphs in Switzerland; (2) M. Schmidlin, managing director of the Swiss Bank Corporation; (3) M. Chapuisat, member of the Legislative Assembly and editor-in-chief of the *Journal de Genève*; (4) Mr. H. W. Allen, joint general manager of Marconi's Wireless Telegraph Co., Ltd., London. The grant of the concession was preceded by a two years' study of the problem whether the organisation of wireless telegraph services should be retained under State control or entrusted to private enterprise. The expert advisers of the Swiss Government recommended private enterprise, and the Swiss Government decided accordingly, also that the co-operation of Marconi's Wireless Telegraph Co., of London, be secured.—*Reuter's Trade Service* (Berne).

The Telegraph Service.—Cable Delays.—The Postmaster-General, during the Parliamentary Debates on February 21st, explained that the delay on the Eastern Telegraph Co.'s cables to India had been due to the large increase of traffic since the war and the continued interruption of the land routes to India and the Far East. To meet the pressure the Eastern Co. laid a new line of cables between this country and Singapore in 1920, and proposed to lay another line to Singapore in the near future. The "urgent" service was introduced as the result of representations from the commercial community, and Mr. Kellaway did not think it would be in the interests of British cable users to abolish it.—*Financial Times.*

Telegraphic Delay.—Owing to a burst water main, all telegraph lines between the Eastern Telegraph Co.'s office in Electra House and the Central Telegraph Office are interrupted, and heavy delay to telegrams to and from places served by the Eastern Co. may be expected. Every effort is being made to restore communication, and the G.P.O. is giving every assistance.

Telephone Developments.—London-Genoa Service.—Direct telephonic communication has been established between London and Genoa for the purpose of the Genoa Conference. The service was tested on February 21st with satisfactory results, communication being very distinct.—*Reuter's Trade Service.*

Message Recorder.—The Poulsen telegraphone, invented many years ago, is a device by which a telephone message can be impressed upon a moving steel ribbon by means of magnetic action. When the ribbon is run through a reproducing device the message is repeated, but so feebly that the invention was abandoned. A simple instrument has recently been invented by M. A. Nasarischwitz, which makes use of thermionic valves to amplify the reproduced message, says the *Daily Mail.*

United States.—Cable Station Closed.—The staff of the Direct Cable Co. at Rye Beach, N.H., has been transferred to New York and other stations of the Western Union cable system, and the cable station has been closed indefinitely. When the English Government purchased the direct cable from Ballinskelligs, Ireland, to Halifax, N.S., the section from Halifax to Rye Beach, N.H., was not included.

Control of Wireless Telephony.—President Harding recently asked Mr. Hoover to call a conference of Army, Navy, and commercial experts on wireless telephony to conduct an investigation looking toward restriction of the use of wireless telephony. President Harding was told that since the broadcasting of news, advertising, music, concerts, and other reports, there had arisen the danger of interruption to the use of the wireless telephone for purposes of national defence and commercial purposes. The proposed conference will report, after its investigation, to the Cabinet, from which will emanate suggestions for enactment of legislation to control the situation. Mr. Hoover selected February 27th as the day on which to hold the conference.—*T. & T. Age.*

Wireless Telegraphy.—Direct Indian Service.—The Indian Government announces, according to the *Daily Express*, in reply to a question in the Legislative Assembly, that an Indian financier whose name cannot at present be disclosed, has applied for a licence to work a direct wireless telegraph service between India and England on the Marconi system.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—April 29th. Electricity Commission. 22,000-V, three-core cable and accessories for the Morwell power scheme. (February 24th.)

Barrow-in-Furness.—Electricity Department. Electrical stores, meters, &c., for 12 months. Electrical engineer.

Belfast.—March 16th. Electricity Department. Six or 12 months' supply of stores, including many electrical items. (See this issue.)

Belgium.—March 22nd. Municipal authorities of Saint Gilles, Brussels. Supply of armoured cables for continuous current and four tons of bare cable. Service de l'Electricité, 40, Rue de Bethléem, Saint Gilles.

March 7th. Service de l'Electricité des Batiments Militaires, 11, Place des Gueux, Brussels. Installation of a transformer cabin at the military aeronautical establishment at Gossoncourt.

Blackpool.—March 16th. Electricity Committee. H.p. switchgear and switch-room equipment for power house and sub-stations. H.p. underground armoured three-core transmission cables. (February 24th.)

March 16th. Electricity Committee. One natural draught cooling tower. (See this issue.)

Bristol.—March 17th. Docks Committee. Four 30-cwt. movable electric jib cranes. Mr. T. A. Peace, engineer, Bristol Docks Committee, Avonmouth Docks.

Cardiff.—March 17th. Electricity Department. One 40,000-lb. water-tube boiler with mechanical stokers and accessories. (See this issue.)

Dublin.—March 8th. G.N. Railway Co. (Ireland). Six months' supply of stores, including electrical fittings, lamps, &c., electric cable and wire. (See this issue.)

Edinburgh.—March 20th. Electricity Department Auxiliary plant and pipework (Spec. No. 41). (February 17th.)

London.—St. Pancras.—March 7th. Electricity Department. E.h.p. three-phase switchgear for two sub-stations. (February 24th.)

Bermondsey.—March 9th. Board of Guardians. Six months' supply of electric lamps. Mr. H. H. Cleeve, clerk to the Guardians.

H.M. Office of Works.—April 12th. Supply of electrical engineering labour in daywork in the Leeds district. (See this issue.)

Merthyr Tydfil.—March 6th. Board of Guardians. Electrical fittings for six months. F. T. James, clerk.

Rhondda.—April 3rd. Electricity Department. Supply of house service a.c. meters, cable, joint boxes, compound, cut-outs, &c., for 12 months. (February 24th.)

Salford.—Tramways Department. General supplies for six months. General manager, 32, Blackfriars Street, Salford.

Wigan.—March 13th. Electricity Department. Steam turbine, 5,000 kW, 3-ph. alternator and exciter, and surface condensing plant. (February 17th.)

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Government Contracts.—The undermentioned Government contracts were placed during January, 1922:—

Admiralty Contract and Purchase Department.

W.T. condensers.—Telegraph Condenser Co., Ltd.
Electrodes.—Alloy Welding Processes, Ltd.; Quasi-Arc Co., Ltd.
Ebonite sheet and rod.—North British Rubber Co., Ltd.
Electric light installation, &c.—G. E. Taylor & Co., Ltd.
Lampholders, &c.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; W. McGeoch & Co., Ltd.; Sperryn & Co.
Switches.—Dorman & Smith, Ltd.; Verityş, Ltd.
Water coolers.—Heenan & Froude, Ltd.
Battery accumulators, &c.—Fuller's United Electric Works, Ltd.
Cells, &c.—London Battery & Cable Co., Ltd.
Insulating material for W/T apparatus.—Micanite & Insulators Co., Ltd.
Petrol-electric lorries.—Stevens' Petrol Electric Vehicles, Ltd.
Motors, generators, and switchgear.—Bruce, Peebles & Co., Ltd.
Motor generators, control gear.—Johnson & Phillips.
Motor generators, starters.—Metropolitan-Vickers Electrical Co., Ltd.
Motor generators.—Metropolitan-Vickers Electrical Co., Ltd.

War Office.

Electric cells.—Ever-Ready Co. (Great Britain), Ltd.; General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.
Electrical installations: Switchgear for Lands End power station.—Metropolitan-Vickers Electrical Co., Ltd. Chelsea Barracks.—Drake and Gorham, Ltd.

Crown Agents for the Colonies.

Electric motors, &c.—General Electric Co., Ltd.
Telephone line material.—Bullers, Ltd.
Transformer.—British Insulated & Helsby Cables, Ltd.
Wire.—Hooper's Telegraph & I.R. Works, Ltd.

Air Ministry.

Amplifiers.—Marconi Scientific Instrument Co., Ltd.
Inert batteries.—Siemens Bros. & Co., Ltd.
Condensers.—H. W. Sullivan.
Wireless switchboard.—Erskine, Heap & Co.
Transmitters.—Johnson & Phillips, Ltd.
Wireless valves.—General Electric Co., Ltd.

General Post Office.

Telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Telegraph and telephone cable.—Enfield Ediswan Cable Works, Ltd.
Loading coils.—Western Electric Co., Ltd.
Joint-box castings.—Bailey, Pegg & Co., Ltd.; United Steel Companies, Ltd. (T. Butler & Co.'s branch).
Compound.—Dussek Bros. & Co., Ltd.
Ducts.—Donington Sanitary Pipe & Firebrick Co., Ltd.; Doulton & Co., Ltd.; Ensor & Co., Ltd.; Hepworth Iron Co., Ltd.; J. Oakes and Co.; G. Skey & Co., Ltd.; Stanley Bros., Ltd.
Telephone earpieces.—General Electric Co., Ltd.
Laying conduits.—The list contains the names of a large number of firms with which contracts have been placed for laying conduits in different parts of the country.
Telephone exchange equipment, Buxton.—Peel-Conner Telephone Works Co., Ltd. Sub-contractors: Tudor Accumulator Co., Ltd. (for batteries); Crompton & Co. (for charging sets).

H.M. Office of Works.

Engineering services.—Electric wiring Acton offices: Alpha Manufacturing Co. Electric wiring Bandeath houses: Grindlay, Ross & Co., Ltd.

Burton-on-Trent.—Board of Guardians. Accepted:—
Installing electric light at the hospital.—Logie, Ashmole & Co.

Johannesburg.—*South Africa* gives particulars of the tenders received recently by the Municipality for cable. It was reported to the Tramway and Lighting Committee that for the .6 s.c. traction cable the lowest tender was that of the Griffin Engineering Co., for cable manufactured by the A.E.G., Germany, at 13s. per yard; delivery in three months. A covering letter stated that the cable offered was strictly in accordance with the British engineering standards, as called for in the specification. The second lowest tender was that of the Metropolitan-Vickers Co., for cable manufactured by Messrs. W. T. Glover & Co., at 13.96s. per yard; delivery in three to four weeks at works, British engineering standards guaranteed, but prices subject to confirmation. The third lowest tender was that of Henley's S.A. Telegraph Works, for cable manufactured by Henley's, England, at 14s. 7½d. per yard; delivery four weeks at works, subject to prompt acceptance, failing which tenderers reserved the right of adjustment in accordance with market fluctuations of copper and lead. As a final result, the Town Council, on the recommendation of the Committee, accepted the following tenders:—(*a*) Metropolitan-Vickers Electrical Co., Ltd. (most suitable): 2,000 yards .6 square in. single-core traction cable, at 13.96s. per yard, £1,396 (firm price, but subject to confirmation), and in the event of the Metropolitan-Vickers Co. failing to get confirmation, that the next lowest tender be accepted, viz., Henley's S.A. Telegraph Works, Ltd.: 2,000 yards .6 square in. single-core traction cable, at 14s. 7½d. per yard, £1,462 10s. (*b*) Henley's S.A. Telegraph Works Co. (lowest): 550 yards .6 by .6 square in. concentric h.p. cable, at 23s. 9d. per yard, £653 2s. 6d. (firm price, subject to confirmation; penalty clause deleted).

London.—L.C.C.—Highways Committee. Three water-tube boilers, superheaters, economisers, &c., for the Greenwich power station :—

	£
Clayton & Shuttleworth, Ltd.	58,000
Ditto (alternative offer, inc. multiple retort stokers) (Accepted)	**61,302**
Clarke, Chapman & Co., Ltd.	68,994
British Niclausse Boiler Co., Ltd.	69,618
Stirling Boiler Co., Ltd.	75,000
Babcock & Wilcox, Ltd.	80,551
Ditto (alternative offer, including Riley stokers)	84,664
Vickers, Ltd.	65,345 (excluding stokers)
Underfeed Stoker Co., Ltd.	+9,755
Ditto (alternative offer)	+10,391
Ditto ditto	+11,315
Ditto ditto	+11,424
Erith's Engineering Co., Ltd.	+12,490

†Stokers and fans only.

Foundry plant for the Central Repair Depôt.—Alldays & Onions, Ltd. (£1,017).

Supply of 2,600 tons of track rails and fastenings during six months, and, alternatively, 4,700 tons during twelve months :—

	2,000 tons. £	4,700 tons. £
Société Metallurgique des Terres Rouges ...	26,973	48,475
Société Anonyme D'Ougrée Marihaye	27,835	50,066
Andrew Brown & Co.	28,002	48,175
Walter Scott, Ltd.	28,667	50,307
Anglo-Belgian Improvements Corporation ...	28,750	51,707
Dorman, Long & Co.	29,746	53,446
United Steel Products Co.	33,185	58,372
Steel, Peech & Tozer, Ltd.	33,397	59,728
F. Mott & Co., Ltd.	36,354	67,108

The lowest three tenders are for rails manufactured on the Continent. The Committee has decided, subject to negotiations with the company regarding the quantity of rails that may be required, to accept the tender of Messrs. Walter Scott, Ltd.

Perth.—Electricity Committee. Accepted:—

New boiler.—Babcock & Wilcox.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturdays, March 4th and 11th. At Albemarle Street, W. At 3 p.m. Lectures on "Radio Activity," by Sir Ernest Rutherford, F.R.S.

Institution of Electrical Engineers (Informal Meeting).—Monday, March 6th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "E.h.t. Cable Testing," to be opened by Mr. E. Ambrose.

(Western Centre).—Monday, March 6th. At the Merchant Venturers' Technical College, Bristol. At 6 p.m. Paper on "Induction-type Synchronous Motors," by Mr. L. H. A. Carr.

(South-Midland Centre).—Students' Section : Tuesday, March 7th. At the University, Birmingham. At 7.30 p.m. Paper on "The Measurement of Flux-density in the Air Path of a Magnetic Circuit," by Mr. W. P. Conly.

(Irish Centre, Dublin).—Friday, March 10th. At the Royal College of Science. At 8 p.m. Paper on "Wireless Communications in the Campaign in France," by Prof. R. Stanley.

(North-Western Centre).—Friday, March 10th. At the Engineers' Club, Manchester. At 7.30 p.m. Exhibition of Kinematograph Films, by Dr. C. C. Garrard and Mr. F. Gill.

(East-Midland Sub-Centre).—Tuesday, March 7th. At the Technical College, Derby. At 7 p.m. Paper on "The X-ray Examination of Materials," by Mr. J. F. Driver.

Royal Society of Arts.—Monday, March 6th. At John Street, Adelphi, W.C. At 8 p.m. Cantor lecture on "The Modern Design of Scientific Instruments," by Prof. A. C. Pollard.

Wednesday, March 8th. At John Street, Adelphi, W.C. At 8 p.m. Lecture on "The Proper Functions of Trade Unions," by Mr. W. A. Appleton.

Society of Engineers (Incorporated).—Monday, March 6th. At Burlington House, Piccadilly, W. At 5.30 p.m. Paper on "The Testing of Small Electrical Plant," by Dr. C. V. Drysdale.

Roentgen Society.—Tuesday, March 7th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. Ordinary meeting.

Association of Engineers-in-Charge.—Wednesday, March 8th. At St. Bride Institute, Bride Lane, E.C. At 7.30 p.m. Paper on "Thermal Efficiency of Small Power Stations and Methods of Comparison," by Mr. A. H. Seabrook.

Industrial League and Council.—Wednesday, March 8th. At Caxton Hall, S.W. At 7.30 p.m. Lecture on "The Personal Factor in Industry," by Miss B. Voysey.

Institute of Metals.—Wednesday and Thursday, March 8th and 9th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 10 a.m. each day. Annual general meeting.

Wednesday, March 8th. At the Trocadero Restaurant. At 7.30 p.m. Annual dinner.

Institution of Railway Signal Engineers.—Wednesday, March 8th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 2.45 p.m. Special general meeting. At 3 p.m., discussion on "Signal Replacers," to be opened by Mr. B. W. Cooke.

Institute of Cost and Works Accountants.—Wednesday, March 8th. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 7 p.m. Paper on "Costing and its Relation to Production," by Mr. G. H. Hale.

Manchester Wireless Society.—Thursday, March 9th. At the Albion Hotel, Piccadilly. At 8 p.m. Paper on "Materials Used in the Construction of Aircraft," by Mr. F. E. Fozard.

Electro-Harmonic Society.—Friday, March 10th. At the Great Hall, Cannon Street Hotel, E.C. At 8 p.m. Smoking concert (the last of the season).

Edinburgh Electrical Society.—Friday, March 10th. At the Philosophical Institute. At 8 p.m. Papers on "Installation Work," by Mr. T. M. Buist; and "Fault Localisation," by Mr. D. M. Buist.

Junior Institution of Engineers.—Friday, March 10th. At 8 p.m. At Caxton Hall, S.W. Paper on "Friction," by Mr. G. H. Plant.

Physical Society of London.—Friday, March 10th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

Birmingham and District Electric Club.—Saturday, March 11th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Ball Bearings," by Mr. A. Macaulay.

National Association of Supervising Electricians.—Tuesday, March 14th. At St. Bride's Institute, E.C. At 6.45 p.m. Paper on "The Determination of Heat Loss From Buildings, with Special Reference to Electrical Heating," by Mr. W. T. Nobbs.

Institution of Civil Engineers (Students' Meeting).—Wednesday, March 15th. At the Institution, Great George Street, S.W. At 6 p.m. Vernon Harcourt Lecture on "The Great Ship-Canals of the World," by Mr. G. Fitzgibbon.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of :—

Suppliers of Dekla hand-operated lever torches.
Rita or Riter electrical dental appliances.

NOTES.

The Wimbledon Case.—As the Mayor of Wimbledon (Ald. Mussell) declined to call a town's meeting, as requisitioned by a large number of ratepayers, to consider the action of the Council in summarily dismissing the borough electrical engineer (Mr. H. Tomlinson Lee), a public meeting was held on Monday night at the Wimbledon Baths Hall, presided over by Mr. Ald. H. W. Simpson, at which more than 2,000 persons were present, including several past and present members of the Council. Amongst the various speakers was Sir Arthur Holland (a past chairman of the Corporation Electricity Committee) who described the action of the Council as monstrous in dismissing an old and trusted servant without giving a reason. On the motion of ex-Councillor R. D. Pond, seconded by ex-Councillor A. D. Webb, a resolution was carried protesting against the action of the Electricity Committee and the Borough Council in summarily dismissing the electrical engineer without any statement of the reason, and demanding a public inquiry before any action was taken. Copies of the resolution were ordered to be sent to the Mayor of Wimbledon, the Minister of Health, the Minister of Labour, and the Incorporated Municipal Electrical Association.

A meeting of the Council took place on Wednesday evening, at which the matter was discussed; there was a large attendance of the public, and Councillor Hickmott, chairman of the Electricity Committee, made a long statement, which it was resolved to send to all the bodies which had written to the Council on the subject. Meanwhile some 2,000 people attended a meeting of protest outside the Town Hall, and a deputation from it asked the Council for a hearing, but the Mayor ruled against it. The following resolution was passed unanimously by the meeting of protest, of which Mr. R. D. Pond was chairman : "That this meeting condemns the action of the Mayor in refusing to receive the deputation appointed to-night by the ratepayers, and resolves that it has no confidence in the Mayor and those members of the Council (other than the six councillors who attended at the Baths Hall), and calls on them to resign their seats forthwith."

Motor-'bus Repair Works at Chiswick.—In our issue of February 10th (p. 201) we briefly described the new works of the L.G.O.C. for the repair of its large fleet of motor-omnibuses. We referred to the electrical equipment as it existed at the time of our visit, but as in important respects this equipment was only temporary we may now give some further particulars. The main electricity supply is to be taken from the Underground Railway (Lot's Road power house) and fed to Chiswick by two-phase, 11,000-volt high-pressure feeders. Up to the present, however, this supply is not available, so in the meantime it is necessary temporarily to drive the works by utilising direct current (600 volts) taken from the District Railway track current rails which pass the end of the depôt. The majority of the motors for this temporary supply were obtained under special arrangements, from Messrs. C. F. Ferguson & Sons, as already stated. Immediately the a.c. supply is available, the d.c. motors will be replaced by a.c. motors supplied by the Fuller Electrical and Manufacturing Co. These motors are of the squirrel-cage and slip-ring types, wound for 400/415 volts, 33⅓ periods, three-phase supply, and they range from 5 h.p. to 80 h.p. The starting gear is of the drum type oil-immersed double automatic type of Messrs. Erskine Heap & Co.'s manufacture, and supplied by the Fuller Co.

Appointment Vacant.—Junior assistant in the Commercial Department of the Birmingham Electric Supply Department. (See our advertisement pages to-day.)

Fatality.—Robert William Foster (64), telephone lineman, died in the Victoria Hospital at Keighley, on February 23rd, from a fracture of the base of the skull, received the previous day in a fall off a wall of the mill of Messrs. E. H. Gates & Co., at Harden, whilst standing on a ladder removing telephone wires.

The Osram-G.E.C. Lamp Works.—The Duke of York, who seems to be making a speciality of visiting industrial concerns, had an opportunity of gaining an idea of the continual progress that is being made in the electric lamp manufacturing industry when he recently visited the Osram lamp works (proprietors: the General Electric Co., Ltd.) at Brook Green, Hammersmith. An account of a tour of inspection of this spacious modern lamp factory, employing over 3,000

workers, ingenious automatic machinery, and an efficient research department, appeared in our issue of March 25th, 1921, p. 376. The factory is independent of outside aid, which is one of the secrets of its success; every essential to the complete lamp is produced within the range of the G.E.C.'s activities. The accompanying illustration shows the Prince watching the fitting of the filament-carrying stems into the glass bulbs.

The Electrical Research Association.—The annual general meeting of the British Electrical and Allied Industries Research Association was held on February 3rd at the Institution of Electrical Engineers. Mr. W. O. Smith (elected to the chair) expressed regret at the unavoidable absence of Mr. C. H. Wordingham and appreciation of his many services in the past. During the course of his remarks in introducing the first annual report, he referred to the good work done by some fifty committees and the indebtedness of members to those gentlemen who gave so much of their time to this service. Mr. D. N. Dunlop, in seconding the adoption of the report, referred to Mr. Wordingham's indefatigable interest and assistance in all the work of the Association, and the indebtedness of members to those firms who had allowed members of their staffs to give so much time to the work of the Association. He mentioned Mr. A. R. Everest in particular, without whose help the B.E.A.M.A. Research Committee would have laboured under great disadvantages. Whilst a good beginning had been made and the manufacturers had agreed in a public-spirited way to find £8,000 per annum for co-operative research for five years for the benefit of all concerned with the electrical industry, it was becoming exceedingly difficult to find money for such purposes whilst orders were being placed with foreign competitors. He thought that purchasers did not properly appreciate what manufacturers were doing to advance the common interests and how difficult the position was, due to the conditions of international exchange and foreign competition. Mr. C. P. Sparks expressed appreciation of the continuous services of the Finance Committee, of which Mr. W. O. Smith was chairman, and of the invaluable assistance of the B.E.A.M.A. in finding the sinews of war, and the personal services of Mr. D. N. Dunlop in establishing the Association.

Electro-Harmonic Society.—The next smoking concert (the last of the season) will be held in the Great Hall, Cannon Street Hotel, London, E.C., on Friday, March 10th, commencing at 8 p.m. The artistes will be:—Miss Olive Sturgess, soprano; Mr. Oswald Rippon, tenor; Mr. Joseph Farrington, baritone; Mr. Albert Sammons, violin; Mr. George Ellis, entertainer; Mr. Selwyn Driver, entertainer; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

Engineering Golfing Society.—This Society held its thirteenth annual general meeting on February 23rd at the Institution of Civil Engineers, by permission of the Council of the Institution, the retiring captain, Mr. E. W. Timmis, presiding. The annual report and accounts for 1921 were presented, showing a satisfactory increase in membership and a favourable financial position. The following were elected as office bearers for 1922:—

President: Sir Alexander B. W. Kennedy.

Vice-presidents: Messrs. D. A. Stevenson, E. L. Mansergh, F. J. Walker, S. Price-Williams, G. Midgley Taylor, and W. H. Shortt.

Captain: Mr. K. A. Wolfe Barry.

Honorary Secretary: Mr. W. L. Mansergh, 5, Victoria Street, S.W.1.

Honorary Treasurer: Mr. S. R. Lowcock.

Honorary Auditor: Mr. S. C. Lewis.

Members of Committee: Messrs. H. G. Hale, B. J. Hall, C. H. Hayward, R. J. M. Inglis, E. C. MacKeller, J. R. Sharman, G. M. C. Taylor, E. W. Timmis, and A. Valon.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Informal Meetings.—The annual smoking concert of the Section was held on February 27th. A large company of members and guests gathered in the Stephenson Room at the Engineers' Club, London, under the chairmanship of Mr. W. E. Warrilow, who was supported by members of the committee, and a most cheery evening was spent. A good musical programme had been arranged, and altogether the function proved to be very successful.

Conversazione.—The annual conversazione will be held at the Natural History Museum, South Kensington, S.W., on Thursday, June 29th, 1922.

Associate Membership Examination.—Provided that a sufficient number of candidates make application, it is proposed to hold the Associate Membership examination in London and at other places (at home and abroad) in April next. Particulars are obtainable from the secretary of the Institution.

Irish Centre.—Sir John P. Griffith, proposing the toast of "The Electrical Engineers" at a dinner of the Irish Centre of the Institution of Electrical Engineers, in Dublin, expressed a hope that the work before them under the new Government and the new conditions in Ireland would be profitable, not only to themselves but to the country. He trusted there would be some federation of their different societies to operate for the common good.

Replying, Mr. R. N. Eaton, who presided, alluded to the progress of the Institution, mentioning that they were willing and anxious to help the Irish Government in every way they possibly could, more especially in connection with industrial development and utilisation of the power resources of Ireland. They believed Ireland was at the dawn of a new era of prosperity, and that many useful and important power schemes would materialise.

Mr. Darrell Figgis, who responded to the toast of "The Guests," spoke as one who had had much to do with inquiring into and reporting to the Dail Eireann (National Assembly) on Irish resources, and said the agents of three large capitalist concerns were anxious to secure sites from which power might be developed. They had an opportunity now such as was never placed before any other country, and they must learn from the mistakes that other countries had made.

North-Western Centre.—The Council of the Institution has acceded to a request from the above Centre for it to extend so as to include the counties of Carnarvon, Denbigh, Merioneth, Montgomery, the remainder of the County of Flint (part of which is already in the Centre), and the Island of Anglesea.

North-Eastern Centre.—A meeting of members of the North-Eastern Centre was held on February 20th at Newcastle-on-Tyne, when a display of kinematograph films of switchgear, telephones, and the audion was given. A further film sent by the General Electric Co. illustrating the use of electricity in the home concluded the demonstration.

Liverpool Sub-Centre.—Dr. S. S. Richardson read a paper on "An Oscillograph Investigation of the Gulstad Relay" before the Sub-Centre on February 20th. The reading of the paper was illustrated by lantern slides of oscillograms and details of circuits. Dr. Richardson also exhibited and operated a Gulstad relay, and a new form of frequency meter, both of which were very much appreciated. Dr. Marchant pointed out that it was 24 years since the Gulstad relay was invented, but due to the goodwill on the part of the inventor it had never been patented, and in consequence of this, he thought, manufacturers had been rather reticent in developing the relay until more recent times.

Electrical Society of Glasgow.—The draft constitution of the new Electrical Society of Glasgow was presented to a meeting of the members last week. Mr. R. A. Ure, chairman of the Glasgow Branch of the Electrical Contractors' Association, presided over a large attendance. After discussion, the constitution was approved. It is intended that the society shall be representative of electrical contractors, supply authorities, manufacturers, factors, and consulting engineers, and will serve a useful purpose in co-ordinating the efforts of the various branches of electrical engineering in the progressive development of the industry as a whole.

Edinburgh Electrical Society.—At the meeting held on February 24th Mr. D. S. Munro presided, and a paper entitled "Some Experiments on Sound Detection," was read by Mr. Basil Pilkington, F.R.S.E. The lecturer, after remarks on the nature of sound waves and their transmission through different media, illustrated these by demonstration. The paper dealt in detail with various methods of detecting the presence and direction of aircraft and submarines, and the author described his own researches and experiences in these fields during war time. Several receivers, of Mr. Pilkington's own invention, for submarine and other purposes, were exhibited to the members.

Chelmsford Engineering Society.—On February 16th, a paper was read by Mr. C. H. Ford, A.M.I.E.E., on "High-speed Wireless Telegraphy." The present type of wireless plant was fully explained, and it was shown how at the present time messages were sent from London *via* Clifden in Ireland to Glace Bay in Canada and then relayed on to the big towns in Canada, at the same time as messages were sent from Canada to England at a rate of 80 words per minute.

Greenock Association of Electrical Engineers.—At a meeting held on February 22nd, Mr. A. D. Cook, Greenock, in a paper entitled "A Talk on Alternating Currents," skilfully led his audience through the fundamental principles of the theory of alternating currents. The appreciation of Mr. Cook's paper was such that he was cordially invited to continue his paper at an early date.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. Arthur W. Cox, A.M.I.E.E., has been appointed General Manager of Messrs. L. Weeks, Ltd., of Luton.

The Postmaster-General has appointed Mr. E. A. Francis, principal clerk in the secretary's office, London, to be assistant secretary of the Post Office. Mr. W. R. Birchall, clerk, Class 1 (1st Division Establishment), succeeds Mr. Francis as principal clerk. Mr. W. R. Jewell, superintendent of telegraphs, Manchester, has been appointed to be chief superintendent of telegraphs.

Mr. Frank Wright, A.M.I.E.E., has been appointed chief electrical engineer to Messrs. Matthews & Yates, Ltd., in succession to Mr. Wm. Inglis, A.M.I.E.E., who now represents Messrs Laurence Scott & Co., Ltd., in the Lancashire area.

On the adoption by the Dublin Corporation of the Electricity Committee's report upon the retirement of Mr. Frederick J. Allan, secretary of the committee, it was stated that since his release from Ballykinlar Camp, Co. Down, where he had been interned as a political suspect, Mr. Allan had represented that changes had been made in relation to his duties, which made his position an ornamental one, and he, therefore, declined to draw the salary attached to it. He had 21 years' service.

Mr. W. Burrows, of the British Insulated and Helsby Cables, Ltd., was, last week, presented with a case of cutlery by the office staff, on the occasion of his marriage.

Mr. Ronald Grierson, A.M.I.E.E., A.M.I.Mech.E., for twelve-and-a-half years chief electrical and mechanical engineer to Provincial Cinematograph Theatres, Ltd. and its associated Companies, has resigned his appointment in order to take an active interest in a new contracting firm, details of which will be available shortly. In the meantime, manufacturers of cables, conduit, motors, switchgear, fittings, &c., desiring to get into touch with Mr. Grierson, should address correspondence, c/o. 197, Wardour Street, London, W.1. 'Phone: Regent 2226.

Mr. Frederick M. West has resigned his position as manager and director of the A. & A. Electrical Co., Ltd., in order to take up the position of managing director of The London Factors & Agents, Ltd., 38 & 39, Parliament Street, S.W.1. Last year Mr. West acted for a time as chairman of the Lamp Importers' Committee of the Electrical Traders' Association, London Chamber of Commerce.

The Salford Corporation Electricity Committee recommends that the resignation of Mr. J. A. Robertson, borough electrical engineer, who is setting up in practice as a consulting engineer, be accepted, and that for a period of five years, from April 1st, 1922, he be appointed consulting engineer with certain duties as to staff supervision, &c., at a retaining fee of £500 per annum, and travelling expenses. Also that Mr. Robertson be retained to supervise the construction of the proposed new generating station at Agecroft and transmission lines therefrom to Frederick Road Station, at a fee of £2 per cent. upon the total cost theerof, and travelling expenses. Mr. E. H. L. Dickson, deputy borough electrical engineer, is to be appointed resident engineer of the existing electricity undertaking of the Corporation, at a salary of £700 per annum, rising to £750 per annum. Mr. J. Colinge, works superintendent, is to be appointed chief constructional and works engineer at £650 per annum; Mr. L. Romero, mains engineer, is to be appointed distribution superintendent, at £650 per annum; Mr. W. Mawdsley, constructional draughtsman, is to be appointed Chief Constructional draughtsman, at £450 per annum; Mr. H. M. Crosfield, chief clerk, is to be appointed chief commercial assistant, at £350 per annum, plus the Civil Service scale of war bonus; and Mr. F. Valentine, borough electrical engineer's secretary, is to be appointed secretary to all the before-mentioned engineers, and have charge of all the correspondence of the electricity undertaking of the Corporation, at £300 per annum, plus the Civil Service Scale of War Bonus.

With reference to the announcement made here several weeks ago, the Manchester Corporation has now accepted the resignation of Mr. J. M. McElroy, the tramway manager, his health having failed as the result of the strain of the last few years. The chief accountant of the department, Mr. James Wood, who has been Mr. McElroy's assistant for the last eight years, and has been connected with the Manchester system for 22 years, has also resigned for a similar reason.

The Hereford Council received 135 applications for the post of chief electrical engineer, and has appointed Mr. James Makin, chief electrical engineer, Bexley, and engineer and general manager of the Bexley Council tramway and Dartford light railway joint undertaking.

Obituary.—Herr Reinhard Mannesmann.—Berlin Press dispatches report the death of Reinhard Mannesmann, the head of the Mannesmann tube works.

Dr. J. J. Sulzer-Imhoof.—The death is announced from Zurich, at the age of 66 years, of Dr. J. J. Sulzer-Imhoof, the senior member of the well-known engineering firm of Sulzer Gebruder, of Winterthur, Switzerland, and a son of the founder of the concern.

Mr. Druitt Halpin.—We regret to read in *The Times*' "Deaths" column that Mr. Druitt Halpin, M.Inst.C.E., M.I.Mech.E., passed away at Gunnersbury on February 27th after a long illness. Mr. Halpin was the inventor of the thermal storage system which was employed at the Shoreditch electricity works and elsewhere, and formed the subject of so much discussion many years ago.

Mr. Randall B. Slacke.—As we go to press we learn, with great regret, of the accidental death of Mr. R. B. Slacke, M.I.E.E., whilst hunting, on Wednesday last.

Will.—The late Sir Charles Albert King, formerly Comptroller and accountant-general of the Post Office, left £3,398 gross.

NEW COMPANIES REGISTERED.

Foundation Co.—The Foundation Co., Ltd., has been registered as a "private" company, with a nominal capital of £250,000 in £1 shares (150,000 8 per cent. cumulative preference and 100,000 ordinary). The objects are: To acquire, upon the terms of an agreement with the Foundation Co., of New York, the goodwill and rights referred to therein; to acquire, rent, build, improve, work or control in any part of the world works and conveniences of all kinds, including roads, railways, tramways, docks, harbours, piers, wharves, canals, reservoirs, bridges, irrigation, hydraulic, electric, gas, drainage, engineering and improvement works, cables, flour, grain, saw, paper, pulp and crushing mills, boxmaking and printing works, foundries, bakeries, carrying or transport undertakings, hotels, ships, lighters, newspaper and other publications, breweries, public and private buildings, residences, places of amusement and recreation, and to carry on the business of electrical, mechanical, hydraulic, and general engineers and contractors, manufacturers of and dealers in machinery, apparatus, vehicles, engines, aircraft, tools and appliances, chemists, druggists, manufacturers of and dealers in chemicals, bankers, capitalists, financiers, and merchants, &c. The subscribers (each with one share) are: F. D. Billett, 2, Bond Court, Walbrook, E.C.4, clerk; W. J. Hill, 2, Bond Court, Walbrook, E.C.4, clerk. The directors are to be nominated by the vendors to and promoters of the company, and they are authorised to act as directors for acquiring, on behalf of the company from the above-mentioned company, the goodwill and rights referred to in the said agreement, and, *inter alia*, of making all payments thereunder and the allotment as fully paid the 100,000 ordinary shares referred to therein. The first directors are not named. Remuneration (except that of a director, whose remuneration is to be fixed by agreement), £500 each per annum (chairman, £750). The net profits available for distribution, after providing for dividend on the shares ranking in priority to the participating preference shares and after setting aside sums for reserves or contingencies or to carry forward to the next year, as the directors may think advisable, shall be applied (1) with paying 8 per cent. dividend on the cumulative preference shares; (2) in carrying 50 per cent. of the remainder to a special reserve fund called the "Participating Preference Shareholders' Reserve Fund" until the amount reaches £100,000; and (3) the other 50 per cent. in paying an 8 per cent. non-cumulative dividend on the ordinary shares and thereafter in paying further dividends on the preference and ordinary shares as though they were of one class. The sums borrowed by the directors and outstanding shall not exceed the amount of the nominal capital without the sanction of a general meeting. The registered office is at Windsor House, Kingsway, W.C. The file number is 179,870.

Brasse, Ltd. (179,842).—Private company. Registered February 21st. Capital, £10,000 in £1 shares. To acquire the business carried on by E. P. Brasse, and to carry on the business of electrical, cable, and surgical instrument manufacturers, druggists' sundriesmen, electrical engineers, metal workers, &c. The first directors are: E. P. Brasse, 6, The Hawthorns, Church End, Finchley, N. (permanent); E. W. Brasse, 6, The Hawthorns, Church End, Finchley, N. Qualification (except original directors), 100 shares. Remuneration as fixed by the Board. Registered office: Calvert Works, South Tottenham, N.

Trackless Cars, Ltd. (179,860).—Private company. Registered February 21st. Capital, £10,000 in £1 shares. To adopt an agreement with G. A. Bishop and R. A. Chadwick, and to manufacture and deal in electric trackless or railless trams, cars, and trolley cars, and omnibuses and their component parts, &c. The first directors are: G. A. Bishop, "Kenneythorpe," 337, Roundhay Road, Leeds, engineer; G. H. Kitson, "Westwood Croft," Leeds, engineer; H. E. Catton, 1, Wetherby Road, Roundhay, Leeds, steel manufacturer; T. F. Braine, "Donisthorpe," Moortown, Leeds, engineer; H. England, R. A. Chadwick, E. W. Campbell, W. H. Turner, R. Blackburn, and J. Wright, no addresses given. Qualification, £250. Remuneration not more than £300 per annum, divided between them. Secretary: J. Eagleton. Registered office: Hepworth's Chambers, 142, Briggate, Leeds.

James Moores & Co. (Sundries), Ltd. (179,790).—Private company. Registered February 18th. Capital, £5,000 in £1 shares. To acquire the business carried on by J. Moores at 14, Ridgefield, John Dalton Street, Manchester, as "James Moores & Co.," and to carry on the business of manufacturers of, dealers in and/or agents for electric lamps, accessories, cables, wires, flexibles, and glassware for electrical, gas, lighting, and other purposes, engineering sundries, rubber, balata, vegetable and mineral oils, vegetable nuts, copra, beer, stout, spirits, wines, and any other alcoholic and non-alcoholic beverages, vulcanisers for motor-cars, cycles, and transport waggons, brushes, &c. The first directors are: J. Moores, 14, Ridgefield, John Dalton Street, Manchester; Dr. R. H. King, 11, Egmont Road, Sutton, Surrey, life directors; J. Higginbotham, "Mark Beech," Sutton, Surrey; P. Moores, 14, Ridgefield, John Dalton Street, Manchester. The two first-named are managing directors for three years, with £416 per annum as remuneration, provided that the said Dr. R. H. King shall not be entitled to any remuneration as managing director until he becomes actively engaged in the business. Dr. R. H. King has the right to nominate M. R. King as a director. Qualification, £100. Remuneration as fixed by the company. Registered office: 14, Ridgefield, John Dalton Street, Manchester.

Reynard Electrical Co., Ltd. (179,910).—Private company. Registered February 23rd. Capital, £500 in £1 shares. To carry on the business of manufacturers, importers, and exporters of, agents for and dealers in lamps, brackets, shades, connections, switches, ceiling roses, plugs, cable, conduit, motors, and all electrical apparatus and accessories, &c. The directors are: J. Cowan, "Brownhill," Dobcross, Yorks. (chairman); W. J. R. Fox, 130, Stamford Street, Brook's Bar, Manchester (both partners in Cowan & Fox). Registered office: Dickinson Street, Manchester.

Cardiff Electrical Repairs, Ltd. (179,894).—Private company. Registered February 23rd. Capital, £1,000 in £1 shares. To take over the business of electrical and mechanical engineers carried on by E. A. Waugh and T. Richmond at Northcote Lane, Cardiff, as the "Cardiff Electrical Repairs Co.," and to carry on the business of electrical, mechanical, motor, and general engineers and contractors, manufacturers, repairers, fitters, painters and decorators of motor-cars, &c. The permanent directors are: E. A. Waugh, 26, Gordon Road, Cardiff; T. Richmond, 110, Claude Road, Cardiff. Qualification, £100. Remuneration, £50 per annum, divided between them. Manager: E. A. Waugh. Solicitor: T. J. Shackell, 2, Church Street, Cardiff.

National Signs, Ltd. (179,824).—Private company. Registered February 20th. Capital, £42,000 in £1 shares. To acquire the business of National Signs, Ltd. (in liquidation), to adopt an agreement with the said old company and W. H. Worrall (its liquidator), and to carry on the business of electrical and illuminated sign manufacturers, glass process workers, manufacturers of and dealers in advertising and other signs and novelties, &c. The subscribers (each with one share) are: W. H. Worrall, 1, Gordon Road, Ilford, incorporated accountant; H. H. Scott, 46, Hilldrop Road, N.7, engineer; G. M. Scott, 62, Ramsett Road, Tottenham, N.17, manufacturer. H. H. Scott is to be chairman of directors. Qualification, £100. Remuneration, £150 each per annum. Registered office: Factory Lane, High Road, Tottenham, N.

Townson & Chadwick, Ltd. (179,798).—Private company. Registered February 18th. Capital, £5,500 in £1 shares. To take over the business of an electrician and general engineer carried on by E. Townson at Bark Street, Bolton, as "Townson & Chadwick," and to carry on the same and the business of founders, manufacturers of and dealers in machinery, armature winders, gas engine and motor engineers, garage proprietors, &c. The first directors are: E. Townson, 7, Bank Parade, Preston; J. W. Telford, 12, Rock Avenue, Bolton. Qualification, £100. Remuneration, £10 each per annum (chairman £50). Secretary: J. S. Holt. Registered office: 118, Bark Street, Bolton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Boulton Magnetos, Ltd.—Particulars of £800 debentures, authorised January 31st, 1922. Whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital (if any).

Projector Publicity Co., Ltd.—Debenture dated February 8th, 1922, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. B. Cohen, 121, Grosvenor Road, Canonbury, N.6.

Electric Brass Wares, Ltd.—Particulars of £500 debentures, authorised February 1st, 1922. Whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

J. H. McBean, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital (if any), dated February 17th, 1922, to secure all moneys due or to become due from company to N. P. and O. B., of England, not exceeding £1,000.

British Mica Co., Ltd.—Issue on July 7th, 1921, of £800 debentures, part of a series already registered.

CITY NOTES.

Yorkshire Electric Power Co.

Mr. A. G. Lupton presided at the annual meeting of shareholders, held in Leeds on February 21st. In presenting the accounts and the report (which was abstracted in our issue of February 17th), the chairman said that the year under review had been a difficult one not only on account of the three months' coal strike, but also owing to the after-effects of the war. Nevertheless a slight improvement had occurred, and he believed that throughout the company's district the bottom of depression had been touched, and he looked forward to a gradual decrease of unemployment and a return to prosperity. During the mining dispute the supply had been maintained, although this involved the replenishment of stocks with high-priced coal. In spite of industrial depression the output of energy was at about the same level as in the previous year, which showed a great increase upon the company's previous records. Their charges being arranged according to a sliding scale, the decreases which had taken place in coal prices had reflected upon the amount of revenue. The reduction in working expenses had, however, more than compensated for the decreased income enabling the dividend of 8 per cent. on the ordinary shares to be maintained, after paying interest on an increased capital, and enabling a slightly larger amount to be carried forward. The speaker referred to the sanction given in February, 1921, to the issue of £130,000 debenture stock. Permission was now being asked to issue 111,672 6 per cent. cumulative preference shares of £5 each; and to promote a Bill in Parliament converting both the ordinary and preference shares into shares of £1 denomination, and increasing the capital from £2,000,000 to £4,000,000 with increased borrowing powers. Mr. Lupton referred to the Electricity Commissioners' inquiry into electricity supply in the Aire and Calder district, and said he was confident that a satisfactory arrangement would be arrived at between the municipalities concerned and the company. The growth of the undertaking had necessitated the erection of a new station at Ferrybridge and the laying of new mains; he reminded the shareholders that, whereas the company's revenue in 1905 was only £1,000, in the past year it was nearly £370,000. The company now had 440 miles of mains. At a subsequent meeting the powers asked for by the directors were approved by the shareholders.

Metropolitan Electric Supply Co., Ltd.

The directors state that the capital expenditure during 1921 was £234,356. The gross revenue was £538,470, an increase of £21,876. The working expenses were £329,291, an increase of £10,653. £94,892 has been put to the depreciation and reserve account, making £709,892, from which there has been deducted £49,892, being the discount and expenses of the issue of £500,000 7½ per cent. extension debenture stock made during the year, leaving a balance of £660,000. There is carried to the credit of net revenue account £114,287, which, together with the balance brought forward and interest and dividends on investments, makes a total of £149,184. After deducting interest on debenture stocks, interest on loans and dividend on preference shares, there remains £73,609. The directors recommend a further dividend of 5s. per share on the ordinary shares (being at the rate of 10 per cent. per annum), making a total of 7s. per share, or 7 per cent. for the year. £3,609 remains to be carried forward. An issue of £500,000 7½ per cent. extension debenture stock, made last May, was largely oversubscribed.

New connections, representing 4,277 kW, were added, making the total 53,077 kW. The erection of the additional 20,000-kW plant at Willesden is proceeding satisfactorily, and the trunk mains to link up with the generating station at Uxbridge have been laid. It is expected that the first unit of the new plant will be put into operation in June next, and the whole scheme completed before the end of the year. With regard to the inquiry held by the Electricity Commissioners on schemes submitted, the Commissioners have made a report, indicating the lines on which a scheme will be framed, but neither the London Electricity Joint Committee, 1920, Ltd., nor this company is satisfied with their suggestions. Any scheme will need to be carefully considered, and the board will not assent to any scheme until it has been approved by the shareholders. Meeting: March 7th.

Fife Tramway, Light and Power Co.

At the annual meeting on February 24th, Mr. William Low, who presided, referred to the disastrous effect of the coal strike, and added that other reasons for present-day trade conditions were uneconomic wages forced upon industry and the inability of foreign purchasers to buy British-made goods owing to high costs and adverse rates of exchange. Fortunately, labour and other costs were now on the downward grade, and with the recent reduction in the Bank rate, and with such relief in taxation as could be obtained through the exercise of strict economy on the part of Imperial and local government, industry should revive. Although the power and light output was less than in the preceding year, the business had continued to expand. The number of consumers connected was 3,327, as compared with 2,955 for 1920. The extensions to plant and cables had now been completed, with the exception of trivial details. Should the hoped-for trade revival take place, there should be a marked increase in earnings in view of the increased business connected to the company's system, the fall in cost of coal and wages, together with the economy which would accrue from the operation of the new plant.

South Metropolitan Electric Light & Power Co., Ltd.

At the annual meeting on Monday, Mr. H. St. John Winkworth gave figures indicating the progress made during the last five years. In 1921 the total h.p. connected was 32,387, as compared with 21,411 in 1916, and the number of customers 8,489, as compared with 6,985, while the net revenue had increased from £50,509 to £100,315. By means of modern equipment they were able to keep the cost of production down to the minimum possible in present-day conditions and so to offer favourable terms for power, lighting and domestic supplies. This had had the effect of stimulating the demand for supply, and there was every indication of increased business for the current year. The energy sold to the larger works and factories was less than in the previous year, owing to the depression in industry. With a revival in trade they might confidently look for a considerable extension in their sales from this

branch of the business. The speaker referred to the extended use of shop lighting and private house consumption, due to the removal of restrictions and the satisfaction of consumers. The gross receipts from all sources in 1921 were £216,808, compared with £199,037 in 1920, and the total expenditure was £116,493, compared with £116,216, representing a ratio of cost to gross receipts of 54 per cent., as against 58 per cent. The net revenue of £100,315, compared with £82,821 in 1920. It was difficult to forecast results for 1922, but the position up to the present had been well maintained. The power sold for the month of January showed an increase over last year, while there was a reduction in the coal consumed, and the price was, on the average, lower.

W. T. Henley's Telegraph Works Co., Ltd. The report for 1921 shows that a profit of £263,079 was made. Directors' and auditors' fees, debenture interest, and amount written off for depreciation on buildings, machinery, &c., together absorb £38,339, leaving £224,740, plus £183,538 brought forward, and reserve against Government loans and trustee securities written back, £7,559, making a total of £415,837. From this the following are deducted: Income tax, £26,214; transferred to reserve account, £22,879; dividend on preference shares, £9,000; interim dividend on ordinary shares, £32,500; leaving an available balance of £325,244. The directors recommend the payment of a final dividend on the ordinary shares of 2s. per share, less income tax, making 3s. for the year; this will require £65,000, leaving to be carried forward £260,244. Provision has been made in the accounts in respect of the liability for Corporation profits tax to the end of 1921. £27,121, being the premium of 4s. per share on 250,000 ordinary shares issued during the year, less the expenses of the issue, has been transferred to reserve account. The capital of Henley's Tyre & Rubber Co., Ltd., was, in the early part of the year, increased from £200,000 to £250,000. There has since been great depression in the tire business, but the company has maintained its position in the trade, and is ready to take advantage of any return of prosperity. Meeting, March 3rd.

Electrical Distribution of Yorkshire, Ltd. The net profit for 1921, after payment of interest, was £8,086, against £5,426 for 1920. Including the balance of £1,570 brought forward, the total was £9,656, against £6,579 for 1920. The dividend for the year is 6 per cent. free of tax. £2,000 is put to reserve (making it £10,000), and £2,934 is to be carried forward. The demands for lighting, heating and power continue to grow, and substantial extensions to mains have been made. The Minister of Transport has made an order authorising the company to proceed with the supply of electricity in the districts of Selby, Stanley, Featherstone, Garforth, Horbury, Otley, Penistone and Rawdon, and the order now awaits confirmation by Parliament. Applications have been made by the company for powers to supply electricity in other districts in the West Riding. The Electricity Commissioners have published their preliminary conclusions as the result of their inquiry respecting the Aire and Calder district. The conclusions do not affect the company's powers of supply. During the year applications were received for 13,234 ordinary shares of £1 each, bringing up the issued share capital to £83,234. At extraordinary general meetings held on February 22nd and March 15th, 1921, a special resolution was passed and confirmed increasing the nominal capital of the company from £100,000 to £150,000.

Notting Hill Electric Lighting Co., Ltd. The capital expended during 1921 was £14,916. The connected load advanced from 10,035 kW to 10,929 kW. The consumers number 6,245. The available profit is £41,866, out of which £3,000 is put to depreciation, renewals, and reserve, £3,000 to special reserve, £6,470 is required for income tax, and £1,118 for E.P.D., and other sums are absorbed by the debenture interest and other charges. After paying the preference dividend (6 per cent. less tax) and distributing £518 to staff under the co-partnership scheme, 8s. per share, free of tax, is to be paid on the ordinary shares, leaving £3,920 to be carried forward. The local rates have increased from £3,050 in 1914 to £7,400 in 1921, and the income tax from £1,500 to £6,470. These charges are equivalent to more than a penny per unit sold. The report briefly refers to the Electricity Supply Bill and the inquiry held by the Electricity Commissioners.

Two new 500-kW rotary converters have been installed. With the exception of £1,350 received in the year 1911 on the re-arrangement of the shares, the company has raised no new capital for nearly 20 years, although during that period £75,000 has been expended on capital account. This year, however, it was found necessary to raise funds to meet the cost of extensions, and in December £25,000 of notes bearing 7½ per cent. interest, redeemable at the expiration of seven years, were issued at par. Units generated or purchased, 4,650,537; total sold, 3,201,596. Meeting, March 7th.

Mather and Platt, Ltd. Mr. L. E. Mather, presiding at the annual meeting on Monday at Manchester, said that they were able to pay the same dividend as for the previous year and to largely increase the carry forward, because of the large increase in turnover and because of the profit on the large amount of work in progress brought in from the previous year. The percentage of profit on turnover in 1921 actually was slightly less than in 1920. The increased turnover was made possible by their new extensions with their increased tool capacity, which were completed in time to augment their output considerably. Thus they were able to make deliveries before selling prices had fallen or their stocks had depreciated to any serious extent. They were not carrying forward to the current year so large a volume of work in hand as they did a year ago, and the value was also reduced by the lower prices now ruling.

The speaker referred with deep regret to the death of Dr. Edward Hopkinson, who had had altogether nearly 40 years' service with Mather & Platt. This time last year he was able to report that they had more men employed in their shops than ever before. The result of that happy state of affairs was shown in the results of the year, but for the last few months they, too, had been feeling the trade depression. Their output per man was decidedly increased over that of the preceding year, and although this was to some extent due to the more settled condition of labour, he considered that the system of payment by results which they adopted wherever possible had contributed also to this result. The speaker referred to the threatened lock-out in the engineering trade, and earnestly hoped that agreement might still be possible on a principle that all employers considered vital. Turning to the future prospects, he said that they were obtaining their share of such home contracts as were being placed, but they were not extensive. In France, where they had now established their own French company for sales purposes, business was affected adversely by the rate of exchange, causing their former customers to await improvement, or sometimes even to accept the tempting offers of German firms. Russia was still a closed book, and would remain so until the Government there adopted a sound policy which would attract traders and provide something to exchange other than useless paper. In India they had made good progress with Government departments, native firms, and British traders. The present unrest had, of course, affected trade, but India, being made up of so many races, led one to feel convinced that united action was impossible, except on constitutional lines in accord with the best form of Indian patriotism. They had also work in their shops from other important countries such as Italy, Egypt, China, Japan, Brazil, Scandinavia, and Canada.

London Underground Railways. On February 23rd Lord Ashfield presided over meetings of the shareholders of the four electric railway companies and the L.G.O.C., forming the Underground group. His remarks at each of the meetings are briefly summarised below.

Metropolitan District Railway Co.—Lord Ashfield opened with a reference to the abortive conference between the London County Council and the Common Fund Group which had unsuccessfully endeavoured to reach a common basis for detailed negotiations regarding the London transport problem. He said that the matter had again been brought up by the appointment of the Royal Commission on London Government, which was now sitting. The Underground companies were carefully considering evidence to be put before the Commission at a later date. While there was no objection to a certain measure of public control by an independent body, it was thought that with the control should go a certain amount of protection. Only by private enterprise could the operation of London's transport facilities be successfully carried out. It was not a question of large profits, which were not to be expected in urban transport, but the securing of a reasonable return upon the capital invested. The Underground railways had carried 16 per cent. fewer passengers than in the previous year—a result which was an indication of the stagnation of trade and industry, as a large proportion of the decrease was in workmen's fares. Lord Ashfield then reviewed the extension proposals which had been made and which had failed to secure the Government's approval. (These were briefly outlined in our issue of November 4th last, p. 609.) The Government was asked to guarantee the interest upon the capital needed to carry out the extensions, at a rate not exceeding 6 per cent. on a sum of between five and six million pounds. At the same time, owing to the existence of the Common Fund, the guarantee would not in the ordinary course have involved the Government in any payment at all. However, it was necessary to protect the Common Fund against diminution by unfair competition, and therefore protection against this was asked for. This was not approved, but new proposals were invited. A revised scheme had accordingly been placed before the Advisory Committee under the Trade Facilities Act, and it was hoped that this would secure approval. The chairman next dealt with the Railway Act, 1921. The proposal to include a London group in Part I of the Act had been abandoned, and the Underground Companies therefore came under Part II, relating to the regulation of railways. The group was excluded from Part III, which dealt with railway charges, and the Electric Railway Companies' Fares Act, 1920, continued in force. The financial arrangements made, subsequent to the end of Government control, were beneficial to the company. With regard to the new rolling stock, ordered in 1918, but only delivered during last year,

it was unfortunate that orders had had to be placed when prices were at a maximum, but the exigencies had made it imperative. A temporary loan of £400,000 had been obtained from the bankers for this purpose. The past year had been a satisfactory one. For the first time since 1882 a dividend had been paid upon the ordinary stock; in 1882 the dividend was only 3/16 per cent. No one could be certain about the future, but Lord Ashfield thought that, having once succeeded in paying a dividend upon the ordinary stock, it should be possible gradually to increase the rate in future years.

London Electric Railway Co.—At this meeting the chairman said that 1921 marked the turning point in expenditure. The fall in the Board of Trade's figures of the cost of living had resulted in considerable reductions of bonus and salaries, representing a saving of £240,000 per annum to the company. The total saving in expenditure during 1922 was estimated at £400,000. Many economies had been effected during the past year; a committee of officers had been sitting from week to week reviewing in detail the whole of the company's organisation and methods. As a result, numerous improvements to rolling stock had been made. The fall in the prices of materials occurred too late in the year for a great deal of benefit to be felt. During the year the balance of the debenture capital, £200,000, had been issued. While working expenses had decreased, revenue had increased, resulting in a larger net income. A large amount of expenditure was in suspense owing to the delivery of rolling stock which had not yet been brought into use; the engineers were bringing this out almost immediately. In conclusion, Lord Ashfield said that the continuing fall in expenditure was sufficient to maintain the company in its present position.

Central London Railway Co.—Lord Ashfield stated that 1921 was the first year of continuous working of the Shepherd's Bush-Ealing extension. The railway and stations were maintained by the Great Western Railway, and the service was worked by the Central London Co. Unfortunately the company's share of the traffic receipts had been barely sufficient to meet the expenses incurred. This was chiefly due to the high fares charged, which were 75 per cent. above pre-war rates. The company was endeavouring to arrange with the Great Western Railway to make the fares charged the same as those on the rest of the company's lines; this would lead to increased traffic. The expectations raised by the revision of fares in 1920 had not been realised on account of industrial depression, but, nevertheless, the net income had increased by £94,553. The transfer of the power supply from Wood Lane to Lots Road was still in progress, and a further expenditure of £11,900 was contemplated in this direction. The chairman, in conclusion, said that although decreasing traffics were a source of anxiety, the fall in costs would be sufficient to maintain the company at its present level.

City & South London Railway Co.—The chairman, referring to the adverse effect of trade stagnation upon the companies' traffic, said that the City & South London Co. had suffered still more by reason of the inadequate facilities afforded by the railway on account of the need for enlarged tunnels and more modern equipment. Conditions had not favoured the commencement of these improvements, but, in conjunction with the London Electric Railway Co., an application for financial assistance was being made to the Government under the Trade Facilities Act. The need for reconstruction was emphasised by a decline of 23 per cent. in the number of passengers carried. It was hoped that their application would meet with the Government's approval and that they would be enabled to proceed with the work during the present year. It was satisfactory to note that working costs had fallen considerably. There was only one real obstacle before the company, and that was the large capital expenditure involved in making the railway a worthy partner in the Underground system.

London Electric Supply Corporation, Ltd.

Mr. Robert H. Benson presided at the annual meeting of the shareholders, held on February 21st. Presenting the report, he said that 1921 was a year of great difficulty, chiefly on account of the coal strike and high rates and taxes. When complaint was made that private enterprise was blocking the way to cheap power, the public should remember, among other factors, the increase of rates. In the company's case these were £11,845 in 1914 and £48,400 in 1921. Local authorities should endeavour to give relief from these rates rather than taking on the risk of supplying electricity, perhaps to increase the rates. The company had received a gratifying letter from the general manager of the L.B. & S.C. Railway testifying to the value of the company's supply during the strike, which enabled the railway to continue its electric services unrestricted. The present position of the company was rendered unsatisfactory by the option of purchase in 1931 held by the London County Council. What was needed was an extension of tenure long enough to make it possible to borrow money at a reasonable rate and repay it by means of a sinking fund spread over a long enough period not to penalise consumers of the near future for the benefit of consumers 50 years hence. The average dividend of the company had been 1.3 per cent. per annum. Could anyone say that the shareholders had had too large a share of the price paid by the consumer for light and power? Mr. Benson said that between 1903 and 1915 at least 14 private electrical Bills were deposited in Parliament, involving expenditure amounting to £200,000 or £300,000. What was there to show for it? The technical improvements recommended in the Act of 1919, especially with regard to bulk supply, were the same as those proposed nearly 20 years ago, and might have been carried out by this time. They would have kept the industry well in advance of the demand for power instead of behind, as at present.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Exchange Committee under Rule 148a:—

Fellows Magneto Co.—28,654 ordinary shares of 10s. each, fully paid, Nos. 224,238 to 252,891.

North Metropolitan Electric Power Supply Co.—£250,000 8 per cent. cumulative second preference stock, partly paid and fully paid, after issue of allotment letters.

Canadian General Electric Co.—$294,720 common stock.

Montreal Tramways Co.—$1,750,000 first and refunding mortgage five per cent. 30-year gold bonds, Nos. M15,613 to M17,282 ($1,000); and D1,447 to D1,606 ($500).

The undermentioned securities have been ordered to be officially quoted:—

Canadian General Electric Co.—$294,720 common stock.

Montreal Tramways Co.—$1,750,000 first and refunding mortgage 5 per cent. thirty-year gold bonds (Nos. M15,613 to 17,282, $1,000, and D1,147 to 1,606, $500.

Bournemouth and Poole Electricity Supply Co., Ltd.—The capital expended during 1921 was £65,181. The net revenue was £48,193, and the profit on trading account £1,766, plus £6,536 brought forward, making £56,496 available. After paying debenture and other interest, writing £1,733 off preliminary expenses, putting £14,000 to depreciation, renewals, &c., and £5,000 to general reserve, the preference dividends (4½ per cent. and 6 per cent.) are paid, and 6 per cent., less tax, for the year on the ordinary, leaving £4,407 to be carried forward. Units sold, 6,377,163. Applications received increased by 1,320 kW to 17,533 kW. In 1920 the increase was 1,942 kW.

Liverpool Overhead Railway Co.—Gross revenue for 1921 £199,861; working expenses, including appropriations to reserves, £191,993; total passengers carried, 1921, 13,389,857, against 21,020,839 in 1920. There is available for dividend, including £5,577 brought forward, £13,508. The first instalment of the compensation payable under the Railways Act, 1921, to this company was £17,937, and the directors had to appropriate £6,818 of this to pay the preference dividend. No interim dividend could be declared, but a dividend is now recommended at the rate of 5 per cent. for the year on the preference shares, and £5,577 remains to be carried forward.

Smithfield Markets Electric Supply Co., Ltd.—Gross profit for 1921, £10,802, as against £9,262 for 1920; net profit £9,701, against £8,718. £3,500 has been placed to depreciation fund, and £400 to debenture stock redemption fund. A dividend of 5 per cent. per annum on the ordinary shares takes £3,000, £2,000 is put to reserve, and £1,549 is to be carried forward. The output showed considerable improvement; lighting and power demands were both well maintained.

Companies Struck off the Register.—The following companies have been struck off the register, and are thereby dissolved:—

Booth's Economisers, Ltd.
E. B. Magnetos, Ltd.
Indian Railless Traction Co., Ltd.
Kable Electrical Co., Ltd.
Technical News, Ltd.
Wallace Griffin Electrical Co., Ltd.
Western Counties Light Railways Co., Ltd.

North Metropolitan Electric Power Supply Co.—Letters of allotment and regret in connection with the issue of £250,000 8 per cent. cumulative second preference stock of the North Metropolitan Electric Power Supply Co. were posted on Tuesday last week. The stock was subscribed for over thirteen times by more than 3,000 applicants.

Prospectus.—*The Yorkshire Electric Power Co.*—An issue of £558,360 in 111,672 6 per cent. cum. pref. shares of £5 each, fully paid, at £4 per share, was offered last week. It was advertised in the Press on February 23rd and was largely over-subscribed on the same day. The proceeds of the issue will be applied to meet liabilities incurred and expenditure contemplated in connection with important mains and plant extensions.

Underground Electric Railways Co. of London.—Interest on the six per cent. first cumulative income debenture stock was paid on March 1st, less tax, at 3 per cent., and coupon No. 28 of six per cent. income bonds, free of tax, at 2 per cent.

Shawinigan Water and Power Co.—A dividend of 1¾ per cent. for the quarter on the common stock is announced.

Uxbridge and District Electric Supply Co., Ltd.—After putting £10,000 to depreciation fund, a dividend of 8 per cent. is to be paid on the ordinary shares, carrying forward £393.

Vickers, Ltd.—The following final dividends for the half-year ended December 31st, 1921, are announced: 2½ per cent. on preferred five per cent. stock, less tax; 2½ per cent. on five per cent. preference shares, less tax; 2½ per cent. on cumulative preference shares, free of tax.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—Final dividend on the ordinary shares at the rate of 12 per cent. per annum for the half-year, making 10 per cent. for the year, leaving £4,014 to carry forward.

Midland Counties Electric Supply Co., Ltd.—Dividend on the ordinary shares at the rate of 4 per cent. per annum, less tax, for 1921, carrying forward £2,439.

Oxford Electric Co., Ltd.—After paying a dividend of 5 per cent. for the year on the ordinary shares, and putting £3,588 to reserve and renewals, £20 is to be carried forward.

British Mannesmann Tube Co., Ltd.—A dividend of 4 per cent., free of tax, is recommended, carrying forward £55,913.

STOCKS AND SHARES.

Tuesday Evening.

The violence of the upward movement in the Stock Exchange markets has received something of a check. Gilt-edged stocks are not so buoyant as they were. The floods of money which descended into the markets have shown signs of assuagement. People are even turning out stocks in some cases. Owing to the appearance of fresh new issues, offering undoubted attractions, sales are being made of stocks and shares standing at high prices, and the realisation of which gives their holders the opportunity for turning cash into other directions. Markets are hereby rendered more elastic, but, of course, quotations of the older stocks are bound to suffer.

How eagerly people are still on the look-out for sound investments can be illustrated from the rapid manner in which subscription lists close within an hour or so of their opening. Stockbrokers know well enough that their clients have very substantial sums of money on deposit at the banks. This augurs well for the outlook; because, by degrees, the capital will find its way into the House unless, of course, it should happen that trade throughout the country improves. If this happened, money would be required for industry. At the present time there is not sufficient call for money in commercial circles for such a factor to enter into any real competition with stocks and shares combining reasonable rates of interest with sound security.

In the circumstances, it is natural that lists such as those we publish, dealing, that is, mainly with investment securities should make another healthy display. The rises this week are not so dramatic as those chronicled in our last number, but they are widely distributed, and in some cases are of substantial amount. For example, Eastern Telegraph ordinary has risen a further 6 points on top of its similar advance of a week ago. The price is now 183¼. Globe ordinary are no less than £1 up at 18¾, while Anglo-American preferred at 98 exhibits a gain of 3 points. Indo-Europeans at 34 are again £1 higher. Great Northerns and others in this group are substantially better. The rise extended to wireless shares. On the formation of a Marconi Swiss company, the shares of the parent concern rose at one time to 40s., from which they reacted a little, though at 38s. 9d. the price is still 5s. higher on the week. Telephones are equally good, United River Plates at 6¾ being 7s. 6d. up; Chile Telephones at 5 7/16 are 3s. 9d. better. Radio Corporations have dropped sharply to 13s. 6d., the preferred also receding to 12s., the Americans turning round sellers of the shares in consequence of the further rise in the value of the pound as compared with the dollar.

Electricity supply shares are good throughout. Rises of 2s. 6d. to 7s. 6d. are marked freely down the list. Not only are the ordinary shares wanted, but the preferences also attract buyers. City of London preference at £1 are a shilling better. Edmundson's cumulative preference at 3 and the company's non-cumulative preference at 30s. have almost doubled in price within the past fortnight. Urban preference spurted to 27s. 6d. The provincial shares are also harder. Newcastle-on-Tyne ordinary at 12s. 6d. for old and new alike are both firmer, though the company's 6 per cent. second debenture at 92 is below the best. Notting Hill ordinary shares receive 8s. tax-free this time, as against 8s. less tax a year ago. The Metropolitan Electric dividend is 7 per cent. for the year, the same as that for 1920.

Anglo-Argentine Tramways 1st preference enjoyed an unexpected rise of 11s. 3d. The shares had been recommended for investment, and the recommendation was so eagerly taken that the sellers found themselves short of shares. To induce a supply, the price was sharply advanced, without, apparently, meeting any great success up to the present. Sympathetically the 5 per cent. debenture went up 4 to 76½. British Columbia Electric stocks are better, with the exception of the deferred, which lost a point of its last week's gain of 3 points. Brazilian Tractions are 4 up, at 40.

In the Home Railway group, Central London assented ordinary at 60 has gained ¼, but the market generally is a little uncertain, and beyond a reaction to 2½ in Underground Electric ordinary shares, no particular changes have occurred. The prior-charge stocks remain firm, though here the recent extraordinary rise has brought in a few sellers, and the supply of stock available for purchasers is accordingly widened. Central London 4 per cent debenture stock at 74 has gained a point, but on the other hand, London Electric 4 per cent. preference at 70 is below the best price touched a few days ago.

It is expected that the allotments of the Yorkshire Electric Power preference shares will be out this week, and a good deal of interest attaches also to the allotments of the North Metropolitan preference stock, which will be in the hands of subscribers before this paper is.

Babcock & Wilcox recovered to 2½, and iron and steel shares keep up fairly well. British Aluminium at 15s. are easier. The cable manufacturing shares are good throughout, rises having occurred in Callenders, Henleys, Telegraph Construction and Siemens. The last-named at 25s. are 2s. higher on the week. General Electrics advanced to 21s. 9d., the preference to 20s. 9d., and English Electric preference at 13s. 9d. are 1/16 up. Edisons recovered 1s. to 5s. There is more disposition now than there has been for some time past to look with a friendly eye upon low-priced electrical shares. The rubber market is the turn harder, for which a faint recovery in the price of the raw produce is responsible.

Last week it was mentioned as a matter of interest, that 36 prices in our lists were higher. In spite of the slight Stock Exchange reaction, due to the less rapid pace of the purchasers, our tables of 70 stocks and shares have 40 rises to their credit.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1919.	Dividend. 1920.	Price Feb. 28, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7	+ ½	£3 11 6
Charing Cross Ordinary	7	8	5⅝	+ ⅛	6 19 2
do. do. 4½ Pref.	4½	4½	8½	—	6 18 6
Chelsea	4	6	4¼	+ ¼	7 6 0
City of London	13	14	14	—	9 6 8
do. do. 6 per cent. Pref.	6	6	1	+1/-	6 0 0
County of London	8	8	10½	+ ½	7 18 0
do. do. 5 per cent. Pref.	6	6	9	—	6 13 4
Kensington Ordinary	7	9	6⅞	—	8 10 2
London Electric	2¾	2¾	1⅞	—	8 7 6
do. do. 6 per cent. Pref.	6	6	8½	+ ½	7 14 10
Metropolitan	6	7	4¾	+ ⅛	7 7 4
do. 4½ per cent. Pref.	4½	4½	8 7/16	—	6 15 4
St. James' and Pall Mall	12	12	7⅞	+ ⅛	8 5 6
South London	6	7	2⅜	—	10 9 0
South Metropolitan Pref.	7	7	1¾	+ 1/16	6 4 5
Westminster Ordinary	10	10	6¼	+ ¼	7 8 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98	+3	6 2 5
do. Def.	1½	1½	20⅜	+1½	8 10 0
Chile Telephone	6	6	5 7/16	+ 3/16	8 10 4
Cuba Sub. Ord.	7	7	7½	—	9 6 8
Eastern Extension	10	10	15⅝	+ ⅜	5 8 10
Eastern Tel. Ord.	10	10	183¼	+6	5 9 0
Globe Tel. and T. Ord.	10	10	18¾	+1	5 6 8
do. do. Pref.	6	6	10½	+ ⅛	5 14 2
Great Northern Tel.	22	24	28½	+ ½	8 8 3
Indo-European	10	10	34	+1	7 7 1
Marconi	25	15	1 3/16	+ 1/16	7 14 8
Oriental Telephone Ord.	12	12	2	—	*6 0 0
United R. Plate Tel.	8	8	6⅞	+ ⅛	*6 16 5
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18⅜	+ ⅛	*5 8 10
Home Rails.					
Central London Ord. Assented	4	4	60	+1½	6 13 4
Metropolitan	1½	1½	35	— ½	6 8 7
do. District	Nil	Nil	26	—	8 17 0
Underground Electric Ordinary	Nil	Nil	2½	— ⅛	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	4	2	77½	—	*5 3 4
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5¾	12½	8⅜	+ 3/16	8 3 0
do. do. 2nd Pref.	Nil	5¾	8⅜	+ ⅛	8 3 0
do. do. 5 per cent. Deb.	5	5	76½	+4	6 10 9
Brazil Tractions	Nil	Nil	40	+4	Nil
British Columbia Elec. Rly. Pfce.	5	5	63½	—	7 17 6
do. do. Preferred	5	9/-	62½	+3	*7 9 0
do. do. Deferred	8	12/-	63½	—1	*3 17 6
do. do. Deb.	4½	4½	65	+ ¼	6 16 9
Mexico Trams. 5 per cent. Bonds	Nil	Nil	39½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	38½	—	Nil
Mexican Light Common	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	35½	—	Nil
do. 1st Bonds	Nil	5	65½	+2	7 13 8
Manufacturing Companies.					
Babcock & Wilcox	15	16	92	+ ½	5 16 5
British Aluminium Ord.	10	10	15/-	— 1/16	—
British Insulated Ord.	15	15	144	—	6 17 10
Callenders	15	15	13	+ 1/16	8 11 6
,, 6½ Pref.	6½	6½	17½	+ ⅛	6 7 4
Crompton Ord.	10	10	15/-	+ 1/16	13 6 8
Edison-Swan	10	—	5/-	+1/-	—
do. do. 5 per cent. Deb.	5	5	62	—	8 1 4
Electric Construction	10	10	18/9	—	10 13 4
English Electric	8	8	10/-	—	16 0 0
do. Pref.	6	6	13/9	+ 1/16	8 14 6
Gen. Elec. Pref.	6½	6½	20/9	+1/6	6 5 4
do. Ord.	10	10	21/9	+1/6	9 3 10
Henley	15	15	33/9	+ 1/16	8 18 0
do. 4½ Pref.	4½	4½	8½	—	6 0 0
India-Rubber	10	—	1¼	—	—
Met.-Vickers Pref.	8	8	14	—	8 10 8
Siemens Ord.	10	10	25/-	+2/-	*8 0 0
Telegraph Con.	90	90	95	+1	*4 16 0

* Dividends paid free of Income Tax.

THE INTER-CONNECTION OF A.C. POWER STATIONS.

By L. ROMERO, A.M.I.E.E., and J. B. PALMER, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper discusses the special factors to be considered when designing an inter-connecting link between two a.c. generating stations, with special reference to the importance of power factor phenomena, both on technical and economic grounds.

The division of load in any desired proportion between two alternating-current power stations depends wholly on the adjustment of the steam supply to the prime movers. The mere adjustment of the field strength of generators, or the raising by other means of the voltage at the "sending" end of the interconnector, only causes wattless kilovolt-amperes to flow around the circuit formed by the generators at the two power stations and interconnecting cable, the true power or kilowatts remaining unaltered, except for the load added by the copper loss in the interconnector. Adjustment of voltage, in addition to steam control, is necessary in certain conditions.

There are three main conditions of voltage relationship under which power can be transmitted between two power stations, viz.:—

(1) *Station voltages constant and equal.* The mean power factor of transmission will remain at a constant leading value, the power factors at the station ends of the interconnector varying (but only within small limits) in opposite directions as the load varies or reverses in direction.

(2) *Station voltages constant and unequal.* The power factor of transmission will vary with the load in the direction of lag to lead as the load increases, and *vice versa* as the load decreases. This method is suitable only for transmission of power in one direction.

(3) *Station voltages varied by booster or other means as the load varies.* The power factor may be kept constant at any desired value within the range of the voltage variation available.

Under condition (1) power up to the capacity of the line may be transmitted in either direction without varying the voltage or mean power factor at all. However, the majority of power stations are probably unable to receive and absorb into their systems a bulk supply at a leading (or even unity) power factor, without very serious disturbance to their operating conditions. This method has, therefore, only a limited field of application unless special measures are taken to supply the large wattless component which might be required.

Under condition (2) the voltages are usually fixed to give the most desirable power factor of transmission at full load. This method is used with success in cases where load is transmitted in one direction only. Its advantage over method (I) is that it makes it possible to transmit a fixed load at any desired constant power factor, but it is only suitable for transmitting power in one direction, as a reversal of power would flow at a low leading power factor. Further, as the load varies the power factor of transmission also varies within wide limits, and lastly, with a large voltage-difference in the circuit it would hardly be practicable to operate without a regulator of some kind for the purpose of reducing the voltage-difference when synchronism is approached or departed from, as without this provision the sudden making or breaking of the large wattless current which would flow at no load would have serious effects on the busbar pressure at one or both stations. These considerations appear to rule out a fixed voltage-difference, where that difference has to be large, although this method gives fairly good results under favourable conditions, and where the transmission of power is to be in one direction only.

Condition (3) will be necessary in the majority of cases. The variation of voltage may be obtained either by (*a*) varying the busbar voltages at one or both stations, or (*b*) introducing "boost" in the interconnecting line.

The introduction of boost into the interconnector is the only generally applicable method of varying the voltage relationship between the two stations. The variable boost in the line can be introduced by induction regulators, static boosting transformers with step-by-step regulators, or variable regulating tappings on the main transformers.

For large powers and high voltages the step-by-step regulator is at a disadvantage owing to the difficulty in building remote-control switchgear which will connect with the tappings of the main or auxiliary transformers in the proper sequence without breaking the main circuit. The latter requirement involves the provision of pilot contacts connected to preventive resistances or reactances in order to avoid short-circuiting sections of the transformer winding when passing from one tapping to another. The preventive resistances should be capable of carrying approximately full-load current at a voltage equal to the difference in pressure of adjacent tappings, and in frequent operation the duty may be very heavy. The difficulties encountered in the past with this type of apparatus are not insurmountable, and apparatus which, it is believed, will give satisfactory operation, is now in process of development.

Contactor and face-plate step-by-step regulators are limited to pressures of about 3,000 volts, and their use generally entails the provision of step-down transformers to bring the voltage on the switchgear within this limit, with an additional transformer to apply the boost at the required voltage. These transformers would each require to have a capacity in the same proportion to the full-load rating of the interconnector as the voltage boost is to the line voltage (allowing for transformer ratio), and the otherwise simple and inexpensive arrangement of contactors or face plates becomes formidable under these conditions.

Contactor-type regulators have been constructed which vary the voltage on the line by shifting the neutral point of a star-connected three-phase transformer progressively up or down the winding, four or five taps being provided for this purpose. In order to limit the voltage between the contactor and earth to safe limits the neutral point must be earthed in the regulator, and the system can, of course, only be arranged in connection with a star-connected winding. In spite of these limitations, however, this type of regulator undoubtedly has its field of application.

An induction regulator is in effect a transformer having one winding movable with respect to the other. It can be wound for pressures up to 11,000 volts, and at this voltage is equivalent to the two auxiliary transformers and switchgear constituting the step-by-step regulator.

Interlinking schemes are often required to transmit power in either direction at short notice. This requirement simplifies the lay-out and design of the main and auxiliary apparatus to the extent that the plant at one end of the line can be a duplicate of, and interchangeable with, that at the other end; but the cost of the installation may be increased by it.

In interconnection schemes involving the transmission of large amounts of power over considerable distances it is often desirable to install regulating plant at both ends of the line, each regulator providing half the total capacity required; otherwise the voltage boost provided by the regulator might, in some cases, bring the resultant voltage to a value too far above the nominal transmission voltage.

The power factor at which the transmission of power over the interconnector is to be effected is an important consideration, since the capacities of the line, main transformers, and auxiliary apparatus, depend on it. Further (and especially when the power factor of the normal connected loads on the interlinked power stations is different), it might easily happen that the station receiving power would find itself loaded with wattless kilovolt-amperes to such an extent as to neutralise the advantage anticipated from the interconnection. When the two stations concerned are under the control of one authority, the division of the wattless component will probably be decided on the basis of joint maximum economy, but when one authoritiy is purchasing power in bulk from another the power factor at which the sale of power is to be effected should be agreed upon after full investigation.

Transmission at unity power factor has some considerable advantages. The capacity of the line and transformers, as shown in the paper, can be materially reduced, while the transmission losses are a minimum.

In the author's opinion, while no general case can be made out for the use of synchronous condensers in connection with the interlinking of power stations, particular cases will arise in which substantial economies can be effected by their use, and this possibility should always be kept in mind when installing or extending an interconnecting transmission line.

The method of calculating theoretically the "synchronising power" of an interconnecting line is dealt with in appendices I and II, and observations of one of the authors on the long-distance h.p. transmission systems in the U.S.A. and Canada are added in Appendix III.

DISCUSSION IN LONDON.

MR. P. V. HUNTER opened the short discussion that followed the reading of the paper by congratulating the authors on having included so much useful information into so short a paper that contained so few diagrams. He emphasised the fact that the load was entirely controlled by the steam side of the system, and explained that he had seen "phase swinging" which was purely mechanical and not an electrical condition at all. Those points were fundamental ones. He preferred the induction regulator, although it was more expensive, but it would invariably pay to use it, particularly as by winding the regulator with its series winding in two halves connected in reverse series the resultant voltage could be brought into phase with the applied voltage. He did not care for the title of the paper, because it was not stations they

wanted to interconnect, but the networks. Interconnectors should never exist for that purpose alone; they should also be made to serve as feeders. The scheme outlined by the authors would be the practical solution in future.

Mr. F. H. Clough pointed out that the lagging or inductive component had not been properly dealt with in the paper. He explained that in the case of short tie lines danger might arise from the fact that the total capacity at both ends might be considerably larger than could be safely dealt with by the switchgear, whereas with long lines such trouble might not arise.

Mr. H. Brazil discussed the methods of earthing the neutral point, and quoted figures from actual practice to show that the difference in potentials that existed between the neutral points of two machines operating in parallel was mainly due to the wave form, and was not, in his opinion, sufficiently well appreciated. Machines might not function at all in parallel unless a resistance was inserted in circuit, and when earthed without resistance there might be a considerable loss of neutral point current which was a continuous loss and by no means a negligible one. They should endeavour to reduce the circulating currents as much as possible, and yet allow the full current to pass whenever a fault occurred, and in his opinion the use of powdered carbon resistance would go a long way towards the attainment of that aim.

Mr. J. M. Donaldson, M.C., would not go so far as Mr. Hunter and say that every tie line must also act as a feeder because of the painful cost that would be incurred by the adoption of such an arrangement. He gave some details of the manner in which machines were operated in parallel at the Brimsdown power station of the North Metropolitan Electric Power Supply Co., where the voltage was regulated at one station only; at the other only the excitation was controlled, so that the power factor would be somewhere near that of the station if it was doing its share of the work. Since interlinking the stations the number of cable faults had increased. He did not favour the use of induction regulators in connection with a three-phase supply system.

Mr. G. W. Partridge recalled that 30 years ago he had the privilege of connecting the first two stations in London (probably in the world) together. The problems of inter-connecting stations that were joined by short or long lines were entirely different; when two stations were far apart they could afford to take risks, but when they were near together it was essential to provide for the sub-division of the system immediately anything went wrong. In operating the station at Deptford (London Electric Supply Corporation, Ltd.) and that at Greenwich (South Metropolitan Electric Light and Power Co., Ltd.) in parallel no trouble at all was experienced; governors regulated the load, and the power factor was controlled by means of the excitation. He was inclined to agree that the induction regulator was the best.

Mr. A. R. Everest asked what the authors meant by "the synchronous power which will flow through the line"? They did not mention the internal constants of the generators without which he thought they could not calculate the power referred to.

Messrs. L. Romero and J. B. Palmer, in reply to the discussion, agreed with the remarks that had been made concerning the title of the paper, but there would be cases in which the stations only could be interconnected and not the networks. The cost of induction regulators in the case of short interconnectors would be prohibitive. It was not necessary to make use of all the formulæ that were given in the paper, because all that was required could be obtained by a little manipulation of the modified Kapp diagram they had included in the paper; the point was that the required information could be obtained graphically. The Board of Trade rule that the earth connection shall be made at one point only on the system would have to be modified, and it was important that the whole of an interconnected system should be controlled by one man. They agreed that there were two classes of links—namely, short and long ones; the conditions were different.

Discussion at Newcastle-on-Tyne.

At the North-Eastern Centre of the Institution Messrs. L. Romero and J. B. Palmer read their paper on January 23rd; Dr. W. M. Thornton presided.

Mr. J. R. Beard, in opening the discussion, said they were living amongst interconnection, and perhaps some of them were inclined to regard it merely as a detail, but it was really a matter of importance. The first question that was raised where there was much interconnection was that of pressure, and they had found it in that district necessary to use a lot of regulator "boosting." In America it seemed that it was very unusual to use regulators at all—apparatus which all tried to avoid if they could, but do as they would they usually required a certain number. As to induction regulators, they met the same difficulties as were mentioned in the paper—that was, phase displacement, and he confirmed the authors' remarks as to the use of regulators doubly wound to prevent that effect. The Brown, Boveri regulators they had installed were still in a very good state, and carrying on to the present day. They were of a very simple type and were used at present up to 20,000 volts and, apart from some minor troubles when they were first installed, they had given very satisfactory service. At first the tapping was not quite satisfactory, and they got a little local surging, but the tappings were strengthened, the arresters were scrapped, and for the last seven years they had not heard a word of complaint. Regarding the use of synchronous condensers to increase the mains capacity, if they installed such plant at one end of the line and the demand for electricity continued to increase, then, sooner or later, they would encounter the problem again, and they could not meet it unless they put in another feeder, in which case the expense of the synchronous condenser was more or less wasted. The only way that difficulty could be overcome would seem to be to employ portable condensers, so that they could be moved from point to point as they were wanted. He supposed that it was, perhaps, because load factors in America were so high that they did not require to use so many regulators.

Mr. W. A. Burgess seemed to think it necessary for successful interconnection that there should be something more than hand control. He thought it should be feasible to devise some kind of valve to control the steam input to the turbine which might be operated from the circuit. All the transformers that had been referred to were old types; there seemed to be room for improvement.

Mr. Hughes said the problem in the North-Eastern district was not quite the same as those in many others. There the linking-up was between different stations of one company, or system, and they had not to face those difficulties which arose because one company was buying energy at a bad power factor. Their position was not quite analogous to that of the companies which had to balance at the end of the year to see how they stood.

Mr. W. H. Clothier, Mr. Willis, and Mr. Crompton also raised questions, and

Mr. J. B. Palmer, in the course of his reply, said that so far as earthing in the States was concerned, generally he thought there was no restriction, and earthings were made frequently. The fact was that there was a great difficulty in getting an earth at all. He agreed that a synchronous condenser was suitable in a district where there were conditions such as ruled on the North-East Coast, but in the case they had in mind when the paper was written, a case of two small stations, the argument would not apply.

ELECTRICAL NOTES FROM INDIA.

(From Our Special Correspondent.)

The Bombay telephone service has come in for very severe criticism during the last few months; and, broadly speaking, much of it has certainly been deserved. The telephone company appears to experience great difficulty in securing the services of efficient operators. Most of the trouble appears to be caused by the personal element, and not by electrical equipment. Serious complaints are now made by the public in Calcutta and Rangoon of the inefficiency of the telephone services afforded by the companies in those cities; and the Government has for some time been discussing with the companies what measures can be taken to improve the services. The companies are willing to extend their systems, and to install improved apparatus on condition that they are guaranteed security of tenure under their licences for a further period of at least 20 years. They insist that in view of the increase in working expenses, and the additional capital outlay that is involved, some enhancement in the maximum connection rates charged the public shall be allowed. Draft agreements have been drawn up (says the Associated Press) on these lines in consultation with the representatives of the companies, and have been referred to the local Governments for their opinions after consulting the representative bodies concerned. It is to be expected that if the agreements on the lines proposed are approved the companies will be able before long to afford services of marked improvement, and it is hoped the funds required to finance the undertakings may be raised in India.

During Lord Northcliffe's flying visit to Bombay his attention was called to the vital question of the transmission of news between Home and the East, and he confessed that it was difficult to understand why the French papers in Indo-China receive columns of news by wireless from Paris each day, while India receives little, and sometimes none at all. In Honolulu as much American news appears by wireless as is given to the average American paper, and Lord Northcliffe points out that the Far East is a great field for German propaganda of a nature that the sender considers likely to sow discord among the Allies, or likely to lower their status in other countries.

Mention has previously been made in these notes of the Laxapana-Aberdeen hydro-electric scheme. It appears that the Director of Public Works (the Hon. Mr. T. H. Chapman) has recently made an extended tour in Canada and Switzerland, where hydro-electric schemes are more extensive than in other countries. Mr. Chapman went to study the methods employed in those countries, and to see how far they could be adapted to suit conditions prevailing in Ceylon. He came

away more than ever impressed with the importance of launching a hydro-electric scheme in Ceylon without delay, and has prepared a voluminous report, in the course of which he reviews the subject in the light of the additional knowledge he acquired during his tour. It is well known that Sir William Manning agrees with Mr. Chapman that the Laxapana-Aberdeen scheme offers vast possibilities; and that, although it might not become a paying proposition so far as the Government is concerned, it would certainly constitute a vitally important factor in developing to the full the economic resources of Ceylon.

It is announced that the Government of India has decided to constitute a National Electrotechnical Committee, in accordance with the resolution of the Chamber of Government Delegates at the International Electrical Congress of St. Louis in September, 1904.

The Government is of opinion that the appointment of a national committee may be left in future to the recently-constituted Institute of Engineers (India), but this institution will not possess the necessary authority until it is three years old (*i.e.*, in September, 1923). In the interim the Government Committee will consist of Messrs. A. F. Coubrough (Mather & Platt, Ltd., Calcutta); A. Cochran (Burn & Co., Calcutta); C. D. M. Hindley (Chairman Port Trust, Calcutta).

Subscriptions hitherto paid by the Government of India as a subvention to the Commission, and towards the cost of its publications, will in future be paid by the Committee, to which the Government of India will, for the present, make an annual grant of £130.

The workshops of the Indian Telegraph Service in Calcutta now rank as one of the principal undertakings in the city. The work undertaken includes the production of steel poles, masts and fittings, and a large proportion of the telegraph instruments used by the department, telephone exchange switchboards, certain wireless requirements, and the maintenance of the postal fleet of forty motor lorries in Calcutta. In the instrument branch a system of apprenticeship has been introduced, which is expected to produce a body of workmen skilled in high-class work.

THE NORTH-WEST MIDLANDS ELECTRICITY DISTRICT.

Commissioners' Local Inquiry.

At the Town Hall at Wolverhampton on February 21st, the Electricity Commissioners—Sir John Snell (chairman), Sir Harry Haward, Mr. H. W. Booth, and Mr. W. W. Lackie, who were accompanied by Mr. D. S. Cumberlege—opened an inquiry respecting the area to be included in the North-West Midlands Electricity District,* and to consider a scheme that has been submitted by a Conference of Authorised Undertakers† for the establishment of a Joint Electricity Authority in that area.

The counsel engaged in the inquiry were: Mr. W. Tyldesley Jones, K.C., and Mr. Graham Milward (for the Conference propounding the scheme), Mr. W. Clode, K.C. (for the Shropshire, Worcestershire, and Staffordshire Electric Power Supply Co.), Mr. R. Harker (Walsall Corporation), Mr. A. B. Whitfield (Newcastle-under-Lyme), Mr. H. H. Joy (Cannock Chase Coalowners' Association and Stone Gas & Electricity Co.), Mr. Alfred Tyler (Cannock Chase Colliery Co., the L. and N.W.R., the G.W.R., and the Midland Railway), and Mr. R. T. Sutcliffe (Potteries Electric Traction Co., Ltd.).

Other local authorities were represented by their clerks.

Mr. W. Tyldesley Jones, K.C., explained that only one scheme had been put forward, and there was no opposition to it. There were, continued counsel, differences of opinion as to the best method of carrying out the intentions of the Act of 1919, but as regarded the main principles, there was no difference of opinion between them.

Learned counsel went on to say that there existed in the area the Shropshire, Worcestershire, and Staffordshire Electric Power Co., which obtained in 1903 powers to supply authorised undertakers in those counties. In 1905 and 1906 the company's powers were extended, and in 1918 it acquired provisional orders empowering it to supply part of the district outside the district which that inquiry was dealing with. In 1918 the company obtained from Parliament powers to erect a new generating station and increased powers. The local authorities and the Midland Electric Corporation for Power Distribution, which were supplying the north-west district, took the view that it was desirable in the public interests that the powers of that company (which had never been exercised) should be cancelled. The Bill was strongly opposed by a conference almost identical with the one for which he appeared that day. The result was that without official sanction, the company could not supply energy to any authority that it was not supplying on April 25th, 1918, until two years after the end of the war. The war terminated officially in August, 1921, so that the company was sterilised until August, 1923. It would be for the proposed Joint Electricity Authority to apply for the determination of that company should it so desire. The view taken by the Conference he represented was that for the Joint Authority to be a success it ought to own and work the generating stations. All the authorities represented at that Conference were willing to transfer their generating stations to a Joint Authority. The Conference did not include representatives of the Walsall Corporation; the latter accepted the principle of a Joint Authority, but had certain modifications to propose. There were 14 generating stations in the area, eleven undertakers, eight local authorities, and three companies. The administrative board of the Joint Authority should be representative of the authorised undertakers supplying the district and not big consumers. It was proposed that three new generating stations should be erected at Rugeley, Stoke, and Ironbridge.

Counsel added that it was unique there should be no opposition to the principles of the scheme. The first objection came from Walsall, which agreed to the revision of the boundaries and the setting up of a Joint Authority, but objected to the proposed representation, its point being that no small group of two or three undertakers should have power to out-vote the other authorities. Walsall asked, further, that having regard to geographical and other reasons, the area should be divded into two, with financial autonomy. To that counsel was opposed. Walsall objected also to handing over its generating station, but there was no power to take the station compulsorily, and the scheme could go forward without it. A number of district councils claimed representation on the Joint Electricity Authority. The Stafford Power Co. objected, as it held certain powers under an Act of Parliament to supply certain areas within the district, but those powers had not been utilised. Newcastle-under-Lyme objected principally to the taking over of the generating station, and raised the question of compensation. Cannock wanted representation, and would get it, as it was about to take a supply of energy from the Wolverhampton Corporation. Tettenhall, like other local authorities, wanted representation, but counsel observed that if the Wolverhampton Extension Order passed through Parliament, Tettenhall as a separate body would cease to exist. They were not, he said, interfering with Tettenhall's position at all. If Tettenhall wished to buy the undertaking of the Midland Corporation in its area, it would get under the scheme just what it paid for.

Alderman Harry Leese (Chairman of the Stoke-on-Trent Borough Electricity Committee) was the first witness, and said the Conference accepted the scheme unanimously. Replying to Mr. Clode, K.C., witness said the scheme raised some difficulties, and he was not sure that the easiest way to get over them was to make friends with the Shropshire Co. It was not proposed, he said, to develop in Shropshire for five years, one reason being that there was not sufficient demand. He believed it was proposed to put £720,000 worth of new plant in the existing stations.

Questioned by Mr. Sutcliffe, witness did not think consumers should be represented on the Joint Authority.

In reply to Mr. Harker (for Walsall Corporation) witness agreed that the northern and southern areas of the district were industrial areas, between which was a large agricultural area, with the exception of Stone and Stafford. He admitted that the proposed voting power of the representatives would not do for ordinary business, but he said that scheme was outside the ordinary.

In reply to Mr. Joy (Cannock Chase Coalowners' Association), he did not think a representative of the Association on the Joint Authority would serve a useful purpose.

Mr. Alfred Tyler: If the scheme is a failure, the cost of electricity will rise. Who will pay?—Witness: The consumer.

The inquiry was adjourned at this stage.

When the inquiry was resumed on February 22nd Ald. Leese was further cross-examined by Mr. Whitfield.

Sir Harry Haward inquired whether the Conference was wedded to the proposed method of constituting the Authority, including the arrangement of voting power, or whether some similar scheme would be acceptable to the Conference providing the respective authorised undertakers received their due and proper weight in the constitution of the body?—Witness: I don't think there would be any difficulty about that.

Do you anticipate there will be any difficulty in the transference of generating stations?—I suggest there will be no real difficulty whatever.

The Conference would not object to accept the advice of the Electricity Commissioners should such a difficulty arise?—No, we should take the advice of the Commissioners.

The Town Clerk of Congleton intimated that his Council desired to be included in the scheme.

Mr. Walters (Borough Surveyor of Newcastle-under-Lyme) gave evidence as to the geographical position of the area. Newcastle objected to being linked up with Congleton in the northern district, as between Congleton and Newcastle there was only an area of agricultural land, while all the works and houses were on the other side.

Mr. J. H. Rider (consulting engineer) submitted tables and schedules showing the numbers of generating stations, the type and capacities of the plant, plant extensions authorised and ordered, and other details. Some of the plant, he said, would become obsolete and would be closed down.

*Elec. Rev., Sept. 17th, 1920; p. 307.
†Elec. Rev., Aug. 12th, 1921; p. 231.

There were ten undertakers with fourteen generating stations, and the combined maximum demand of those undertakings for the year ended March 31st, 1921, was 44,284 kW. The average station load factor was just over 30. Witness also submitted financial statistics relating to the undertakings. The average cost per kWh generated for all stations, exclusive of management and other charges, was .961d. The figures varied from 3.647d. for Shrewsbury to .743d. at Wolverhampton, the latter being the lowest. The total cost for the whole of the districts, including distribution, street lighting, management, and capital charges, was 1.552d.—the average over-all cost figure for generating. As regarded the future demand for electricity, witness said the chances were strongly in favour of a continued increasing demand. He estimated that in 1926 the demand would have increased to 82,110 kW, and that the units generated in 1926 would be 205,405,000, and in 1931 284,850,000. Seven per cent. would be taken by auxiliary stations, leaving 191,000,000 and 265,000,000 respectively. The effect of combining the whole of the outputs would be to reduce the amount of plant required by an amount of nearly 2,000 kW. The total load on the six principal stations for the year 1921 was 104,228 kW. Witness estimated that the rising demand in the district would increase to 250,000 kW in 1925. To meet the increased demand three new generating stations would be erected, and the first one, which should be ready by 1926, should be erected at Rugeley, having regard to the water and railway facilities.

Mr. Harker (for Walsall Corporation) considered that no new generating station was necessary for some time; increased demand could be met by the extension of the Birchills main of the Walsall Corporation.

In reply to Mr. Tyldesley Jones, Mr. Harker said the Walsall Corporation did not object to the transfer of the Birchills station, but it was emphatic that the district should be divided into two.

Continuing his evidence, Mr. Rider said that during the first stage, up to 1926, work must be started on a new power station, in order that it should be ready for work when the aggregate demand amounted to 82,000 kW. The witness did not agree that the Birchills station at Walsall could be extended to deal with the demand of 1926.

Replying to Mr. Clode, Mr. Rider said £720,000 would be expended on extending the plant in existing stations in order that they should act as a stand-by for Rugeley. No part of the change would be made without the Electricity Commissioners being first approached.

At this stage the inquiry was adjourned.

The inquiry was resumed on February 23rd, when Mr. J. H. Rider was cross-examined further by Mr. Harker. He agreed that South Staffs. took the greater proportion of the energy generated in the district. He thought there was less chance of expansion in the south because the amount of land available in the south was limited.

Mr. Rider said it was proposed to supply Stafford from Rugeley, and also to supply Stoke. At Rugeley there would be sufficient water from the river Trent for condensation purposes. As a first instalment the Rugeley plant would generate 40,000 kW, and the eventual figure would be 60,000.

Replying to Mr. Tyler (for the L. & N.W. Railway, the G.W. Railway, and the Midland Railway), witness agreed with regard to the electrification of railways that the Joint Electricity Authority should keep in touch with the railway companies, but he did not agree that the best way was to have a railway representative on the Joint Authority.

At a later stage Mr. Tyldesley Jones said it appeared now that the Shropshire Co. was an authorised undertaker, and as such, under the scheme now being propounded, it was entitled to representation on the Joint Authority. It was still the view of the Conference—and they believed it would be the view of the Joint Authority—that an application should be made at a later date for the determination of the company's powers in that area.

In reply to questions by Sir Harry Haward, Mr. Rider said that if the authorities would agree without reservation to put the whole power and operation of stations, purchase of coal, the manner in which they should be run, the hours, the number of staff employed, and what their duties should be in the Joint Authority's hands, ownership of the generating stations would not be desired.

Mr. Meades (Chairman of the Stafford Electricity Committee) said the maximum demand for energy in the town for the year 1921 was 806 kW. To-day that figure had reached 1,200 kW. They had additional plant of 3,600 kW. Messrs. Siemens had signed an agreement for the Corporation to supply energy as from next April, and he believed there would be developments in the neighbourhood in the near future.

Counsel inquired what witness had to say to Walsall's proposal that the district should be divided by a line somewhere south of Stafford?

Witness replied that he could not commit his committee, and added that they could install at Stafford 2,000 h.p. more, but they could do no more, so it was obvious they would have to have help. He thought it best to have one whole rather than two separate districts. He believed there would be great development in the near future between Stoke-on-Trent and the Lichfield district.

(To be continued.)

WATER POWER IN INDIA.

At a meeting of the East India Association on February 20th, Mr. Arthur T. Arnall, B.Sc., M.Inst.C.E., read a paper on "Hydro-Electric Power in India." The author explained that, contrary to the methods which had to be pursued in the acquisition of water-power sites in England, in India concessions had to be obtained from local governments. Under the Land Acquisition Act, 1894, the local governments had power to acquire land for water power schemes and, if they desired, to transfer it to companies. Applicants for concessions were obliged to present definite schemes, and for this purpose a preliminary concession to enable experiments to be made was usually granted. In cases in which the Land Acquisition Act was used, it was necessary to prove to the Government that the proposed development was of public benefit. Public utility schemes were at an advantage in this respect, but developments for the sole purpose of an industry were often difficult, although the prosperity of a country depended upon its industries. In addition to this, power companies were obliged, under the Indian Electricity Act, 1910, to secure a licence from the local government. For long transmission lines further permission was required from the Governor-General in Council. Under the Indian Companies Act, 1913, the local government had power to sanction the payment of interest, up to 4 per cent. per annum, out of capital during the period of construction. While this was satisfactory before the war, conditions had so changed that a higher rate of interest should be permitted, or development would be retarded. The local authority, or in certain cases the local government, had power to purchase compulsorily a licensed undertaking after the expiration of a period not exceeding 50 years, at a sum equal to the fair market value at the time of purchase. This arrangement excluded the generating station itself, unless it was specifically stated to the contrary in the licence.

The difficulties in the way of financing water-power schemes might be met in one of three ways: A Government department might be provided with the means of starting new enterprises; the State might guarantee a certain rate of interest, sharing in profits beyond the amount necessary to pay this rate; or the local authority might take up a majority of shares in the supply undertaking of its district. The last system would suit Indian conditions, but it was doubtful whether the authorities would have funds for this purpose for some years. It was considered that the best thing the Government could do, not having the funds to actively assist new enterprises, would be to make hydro-electric developments more attractive by a review of its policy regarding water-power concessions. Turning to the position of hydro-electric development in India, Mr. Arnall said that surveys had disclosed 130 possible sites with an estimated potential output of 1,774,000 continuous e.h.p., but there was no doubt that this was but a fraction of the possibilities; many millions of horse-power could be obtained from the Himalayas and the great rivers of Burma. Many of these resources would, however, remain untouched until economic transmission of energy over distances of from 500 to 1,000 miles was made practicable. The author gave tables showing first the existing hydro-electric plants, and secondly, the undertakings now in course of construction. In the first list the outstanding feature was the great Tata scheme, in the Bombay district, of 50,000 e.h.p.; the next in size was the Cauvery development of 22,650 e.h.p.; the remainder were undertakings developing from 270 to 5,360 e.h.p.; and the total number of plants in operation was 18, with a total of 91,325 e.h.p. Developments totalling 148,750 were under way, and again the Tata Power Co. had the largest schemes in hand. These were a 75,000-e.h.p. undertaking (the company had plans for eventually doubling this capacity); and that of the Andhra Valley P.S. Co. (one of the Tata interests), 64,000 e.h.p. The Burma Mines, Ltd., had a scheme for the development of 9,750 h.p. in hand. Eighty per cent. of the Indian and Burmese hydro-electric undertakings in hand and completed were supplied by the water-powers of the Western Ghats. From a map shown by the author it was apparent that Bombay benefited very largely because of this fact. There were four schemes in the district which would ultimately be capable of supplying 915,000 e.h.p. at a maximum charge of about ¾d. per kWh. The Igpaturi project, of which details had not yet been worked out, would probably be capable of supplying 20,000 e.h.p. The Andhra Valley Power Supply Co.'s scheme was nearly completed and consisted of six 8,000-kW sets, generating at 5,000 V and 50 cycles. The power from this station would be transmitted to Bombay, a distance of 56 miles, at a pressure of 100,000 V. The Tata station had been in operation for six years. Power was supplied to the Bombay cotton industry at from .5 to .55 anna per kWh. The Koyna River project was capable of an output of 650,000 e.h.p. and was intended to supply energy to electro-metallurgical and electro-chemical industries which would be commenced in the vicinity of Bombay. The author traced the growth of the cotton industry of Bombay, and spoke of the potential demand for electricity which was undoubtedly there, and concluded by saying that the development of the city and the Western Ghats water-powers were, to a great extent, interdependent.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

JUBILEE CONFERENCE, 1922.

(*Continued from page* 260.)

The commemoration meetings of the Institution took place last week in accordance with the programme already published. On Tuesday afternoon and Wednesday evening Dr. Fleming delivered his fascinating lecture on Faraday's discoveries, most admirably illustrated with experiments; on the former occasion Sir Herbert Jekyll, one of the original founders of the Society of Telegraph Engineers, proposed a vote of thanks to the lecturer, and recalled the fact that he himself as a boy had attended Faraday's lectures. Mr. C. H. Wordingham, in seconding the motion, pointed out that Faraday's greatest discoveries were comprised in a period of ten days. On the Wednesday evening Sir Oliver Lodge moved the vote of thanks to Dr. Fleming, which was seconded by Sir Richard Glazebrook.

On Wednesday afternoon Dr. W. H. Eccles presided, and Col. Crompton was the first speaker; his remarks were abstracted in our last issue. Sir Alexander Kennedy, Sir Oliver Lodge, Mr. Sidney Evershed, Mr. A. H. Walton, and Mr. W. Judd gave some of their reminiscences.

On the afternoon of Thursday, February 23rd, Mr. C. C. Paterson, O.B.E., took the chair and spoke his appreciation of the work of those who were contributing to the symposium of reminiscences forming the greater part of the proceedings at the Jubilee commemoration. Before proceeding with the afternoon's programme the members present were asked to approve of a message of remembrance and appreciation to Mr. Oliver Heaviside, suggested by Sir Oliver Lodge the previous day:—

"That the members of the Institution of Electrical Engineers assembled at the Commemoration Meetings being held to celebrate the 50th anniversary of the first meeting of the Society of Telegraph Engineers (now the Institution of Electrical Engineers), with their thoughts directed to all those who in earlier days laid the foundation of the science and industry which the Institution represents, desire to send a message of greeting and remembrance to Mr. Oliver Heaviside, F.R.S., Honorary Member of the Institution.

"In the course of the meetings they have been again reminded of and have recognised the great importance of the classic work achieved by Mr. O. Heaviside and published by him in his papers and writings from 1887 onwards, and especially of his discovery of the importance of inductance in circuits for the transmission of telegraphic and telephonic signals without distortion, and of him as the originator of the methods now being universally applied for this purpose; and in no less measure of his investigations and discoveries relative to the propagation of electromagnetic waves in space, the results of which are now being utilised in wireless or space telegraphy and telephony.

"They are convinced that as now, so in the future the name of Heaviside will be one of the names which will rank among those of the great founders of the science of applied electricity."

Dr. W. H. Eccles introduced the resolution, and referred to the vector algebra notation originated by Mr. Heaviside, but which, unfortunately, had proved too difficult to meet with the appreciation it deserved. The speaker considered that it should be taught in all engineering colleges, and made mention of the fact that it had found application to the Einstein theories—at least the notation used in several books on the subject closely followed Heaviside's earlier notation. It was due to him that we had the loaded long-distance cables of to-day, although it was Pupin who developed and elaborated the theories proposed by Heaviside. In the study of the propagation of electromagnetic waves in air, he showed similar insight, and his name would remain known for many years by the application of his name to the "Heaviside layer" (a name which Dr. Eccles himself had applied).

In seconding the resolution Mr. Ll. B. Atkinson said that it had been said that every advance in mathematics was due to the need for new methods for solving a physical problem, and this was the history of the notation introduced by Heaviside. The latter was a wonderful scientist, and his work had not met with the recognition it deserved, but the message would show him that he was remembered by the Institution of which he was an honorary member.

The first speaker in the list of those relating their experiences of the industry's early days was Sir Charles A. Parsons, F.R.S., who, naturally, dealt with turbines, but confined himself principally to the electrical side of his subject. Dr. S. Z. de Ferranti followed, and included many stories of his introduction to electricity.

The next speaker was Mr. Frank Bailey, and he was followed by Sir Tom Callender, Mr. J. H. Holmes, Mr. W. H. Patchell, and Mr. J. Swinburne, F.R.S.

On Thursday evening, Mr. A. A. Campbell-Swinton occupied the chair, and after proposing a vote of thanks to the Editors of the technical Press for assisting in summarising the commemoration addresses, and to the lay Press for the large amount of space accorded to the celebration, read a letter from Mr. J. S. Highfield, the president, expressing his great regret that he was prevented from attending the meetings.

Mr. J. E. Kingsbury then described the evolution of the telephone system in this country, and was followed by Mr. Bernard Drake, Sir William Noble, Mr. G. W. Partridge, Mr. Arthur Wright, Mr. C. H. Wordingham, and Mr. Ll. B. Atkinson, who summarised the whole of the proceedings.

An abstract of the discourse of Sir Charles Parsons is given below:—

About the year 1884 I determined to attack the problem of the steam turbine and of a very high-speed dynamo and alternator to be directly driven by it. The work commenced with very small-scale experiments, and in such a way that should a few failures occur and re-design be necessary, the expense incurred would not be too serious. A speed of 18,000 r.p.m. was chosen for the first little turbine as being suitable for obtaining, theoretically, a moderate degree of economy, and the estimated output was 10 b.h.p. The equivalent surface speed was about 200 ft. per second, and to guard against the unknown but greatly increased heating at 300 periodicity as against a periodicity of 5 and 10 in the Edison and Siemens dynamos on which the design was based a density of field of one half that of the Edison was aimed at, and the e.m.f. calculated accordingly as directly proportional to the surface speed and the total length of active wire between brushes. The voltage was 100, the length of core 8 in., 96 conductors (.08 in. over the insulation round copper) were laid on a smooth core composed of thin sheet iron .015 in. thick, insulated with paper and threaded on a hollow steel shaft through which lubricating oil passed for cooling purposes. The end windings were spiralled in two layers, and the whole bound with phosphor-bronze wire of 50 tons tensile strength. The commutator had 12 sections, 4 convolutions per section. The density in the armature conductors at full load was about 9,000 A per square inch, but, thanks to the small radial depth of copper, the resulting temperature was not excessive. The efficiency of this dynamo was about 80 per cent., and the steam consumption of the plant about 150 lb. per kWh. This little turbo worked satisfactorily from the start, minor alterations only being found necessary, excepting, perhaps, the commutator, which, after several designs had been tried, was finally made of bars in short sections held by dovetailed steel rings with asbestos insulation, which stood up well against the great centrifugal force. This plant worked regularly for some years, supplying energy for lighting experimental shops, including the early commencement of the Sunbeam incandescent lamp works at Gateshead-on-Tyne.

The electrical constants of this dynamo have been examined recently and found to agree closely with modern dynamo practice modified to suit the speed of 18,000 r.p.m. The design of this dynamo was followed by minor improvements in about 360 turbines of from 1 to 32 kW output, and chiefly used on board ships of the Mercantile Marine, including several Atlantic liners, and also on warships. From 1885 onwards improvements were made in the efficiency of the turbine. The ratio of expansion was increased, the curvature and formation of the blades and other details improved, and the ratio of velocity of blade to velocity of steam increased, so that in 1888 the consumption of a 32-kW turbine with 90 lb. steam pressure and non-condensing had fallen to 34½ lb. per kWh.

In 1887 some ten turbines, of from 15 to 32 kW, supplied energy for the lighting of the whole of the Newcastle Exhibition with high efficiency "Sunbeam" incandescent lamps made by the Sunbeam Lamp Co., of Gateshead-on-Tyne. The filaments were of "tar putty" with 4 per cent. of zirconia, the effect of zirconia being to reduce the resistance as the lamp grew older and the glass darkened, thus maintaining the efficiency. The lamps were from 100 to 500 c.p., consuming from 1½ to 2 W per c.p.; the short life of 200 to 500 hours was accepted as most efficient under the circumstances.

The first high-speed alternator was made in 1888; it had a revolving single-phase armature for 75 kW at 4,800 r.p.m., 80 cycles; four of this type were supplied to the Newcastle and District Electric Lighting Co. The armature body was a smooth laminated cylinder, and the conductor was wound in a single layer around thin longitudinal wood slabs keyed into the core, so as to cover the whole remaining surface of the core, and the whole, after an insulating armouring had been applied, was bound tightly with piano wire. It was driven by a non-condensing turbine.

The first alternator driven by a condensing turbine was of the same type, but for 120 kW, and was built for the Cambridge Electric Supply Co. in 1891. A consumption of 27 lb. of steam per kWh was recorded with steam at 100 lb. pressure, 465 deg. F., and 28½ in. vacuum.

A simple method of ascertaining the losses that occur in an armature was used a good deal on the early plants. The machine was run up to full speed and voltage on the throttle, and when steady working conditions were established small known loads were thrown on and off and the steam pressures recorded. From the data thus obtained the relation between pressure and load in watts was determined. By separately exciting the machine the power absorbed with and without excitation was found. The conductors could then be removed and replaced by wood, and the binding wire was replaced to its original smoothness and same windage loss; the eddy-current loss of the conductors could then be calculated.

In this way a 24-kW armature was tested at 8,400 r.p.m., and the figures were: current to excite field, 360 W; total eddy-current and hysteresis loss in armature, 1,441 W; brush friction on commutator, 1,010 W; calculated C^2R loss in armature, .003 ohm hot, 270 W; total electrical losses, 3,081 W. The total loss in the armature was made up of: steel piano binding wire, 394.6 W; armature core and shaft, 725 W; copper conducting wire by difference, 320.4 W. The loss in brass or phosphor bronze, or delta metal binding wire was inappreciable, but all were found unreliable.

From the commencement it was recognised that very high economy in fuel might be reached with the turbine; that the efficiency would be doubled by condensation; and that the efficiency would increase rapidly with the size, and at a greater rate than in the case of the reciprocating engine. In 1888 estimates were made, guided by experience to that date, which indicated results not far short of those obtained to-day. Partnership difficulties, however, at this period seriously interfered with experiments and manufacture in this direction for several years. In 1899 two 1,000-kW turbo-alternators, 4,000 V, 1,500 r.p.m., were ordered for Elberfeld. Sir William Lindley being the consulting engineer, they were tested before dispatch, the consumption at full load being 18¼ lb. per kWh with steam at 125 lb. and 14 deg. C. of superheat. These were the first turbines to be imported or used in Germany, excepting those of the De Laval type. Up till 1912 continuous-current armatures were made of the drum type similar to those I have described, and in sizes up to 1,200 kW, but for a period of three years we were debarred from this type by the partnership difficulties to which I have referred. The Gramme type had to be used; this was fairly satisfactory up to 200 kW, but beyond this serious heating of the shaft was caused by the cross field within the ring, and asbestos insulation was necessary; the largest made was 400 kW. Reduction gearing having been proved in 1911 to be efficient, reliable, and commercially satisfactory for the transmission of large powers, direct coupling of high-speed continuous-current dynamos was abandoned in favour of geared low-speed dynamos. The first geared d.c. dynamo was sold in 1913; alternators, however, have been and still are direct-coupled to the turbine in most cases. Since 1903 revolving fields have been adopted, first, of the salient-pole type, but in later years of the barrel type, with the exciting coils buried in slots and retained in position by dovetail keys and the end windings by caps of bronze or of non-magnetic steel alloy, a formation which was found to lend itself more readily to the requirements of the rapidly increasing sizes of alternators, which by 1911 had reached 25,000 kW. Alternators of 12,500 kW are now operating satisfactorily at 3,000 r.p.m., and at the present time alternators are being built of 20,000 kW, 0.8 power factor, at 1,500 r.p.m., and also 15,000 kW, 0.8 power factor, at 3,000 r.p.m. In the construction of these machines the finely-stranded type of armature conductor is used, with each strand insulated and spiralled several times in a conductor length. Eddy currents in such a formation of conductor are reduced to a negligible quantity.

With the increasing outputs at high speeds cooling by ventilation has become a very important matter. It is found that the more efficient separately-driven fan is in every respect preferable to a fan mounted directly on the rotor. The closed-circuit system of alternator ventilation is now also being adopted. We have carried out experiments with the water cooling of alternators, both stators and rotors, but with satisfactory results only in the case of the latter. There are at present about 100,000 kW of machines running satisfactorily with water-cooled rotors, but owing to the expense of installing such a system it has been found up to the present that it is better to keep to the usual schemes of air ventilation.

Mr. J. E. Kingsbury's discourse is abstracted below:—

It is something of a coincidence that the year we are celebrating (1872) was also the year when Bell commenced his systematic experiments to put into material form the ideas on electric telephony which had been previously occupying his mind: those experiments culminated in his patents of 1876 and 1877. My first experience of telephonic speech was in 1878, and then through the carbon transmitter which Edison had developed after Bell's discovery of the essential principles had become known. This transmitter gave much more powerful results than the earlier magneto form. To those who have grown up with the telephone as an instrument of daily use I cannot hope to convey an idea of what it was like to talk through the telephone for the first time when it was practically unknown. The line was between No. 6, Lombard Street and the corner of Princes Street. I was at the latter. Scepticism, which was, perhaps, a very natural first impression, had to give way to the absolute knowledge that I had left at Lombard Street the owner of the voice so clearly recognisable. The feeling of awe which came over me I have a vivid recollection of now.

Public demonstrations were always interesting and sometimes exciting. Since that time I have had a good deal of sympathy for those responsible for experimental demonstrations of new apparatus under more or less improvised conditions. At the first demonstration of the Edison loud-speaking receiver at the Royal Society soirée it broke down completely, and I remember the admiration I felt for the coolness of Edison's nephew (who was in charge) whilst taking the instrument to pieces and putting it together again, when all the time an excited crowd of scientists and their friends were waiting at the door for admission. But it was a brilliant success nevertheless. The public début of the Edison transmitter was made at a lecture by Professor (now Sir William) Barrett at the London Institution on December 30th, 1878, in the arrangements for which I was concerned. I remember that in subsequent comments at this lecture the rivalry of Bell and Edison interests was clearly apparent. Sir William Barrett also participated in the first long-distance trial of the Edison transmitter; this was over the Colman's line from London to Norwich, 115 miles, in November, 1878. The line was single, of course, and of iron, and the induction very considerable. My recollection is of a constant cackle through which the spoken words emerged as through a screen.

My firm's office was one of ten (*The Times* office was another) connected to an experimental exchange—the small beginning which was to become the main purpose of the telephone. Although the Bell Co. in London had at an earlier stage started business in the supply of telephones for private-line purposes, it was really as exchange organisations that both the Bell and the Edison companies seriously commenced business. It was in 1879 that this start was made, with experience as was available, and adapting their methods as new conditions were met with.

The telegraph lines which existed were for the service of the public collectively. The lines were consequently few. Telephone exchange service required a line to each individual user. The lines were therefore many, and in the neighbourhood of the exchange itself became congested. Again, telegraph lines were mostly along roads or railways. The telephone required that they should be in crowded areas, and the only available method was to carry them on house-tops. So telephone engineers had to develop new methods for carrying increasing numbers of wires on routes to centralised points. Add to this fact that the telephone pioneers in England had no statutory powers, but were dependent on the permission of private owners for the placing of their fixtures, and you may form some conception of what the line difficulties were. But it was an extensive development of pre-existing conditions. Not so the switching system; the principle of diverting telegraphic lines by means of switching was old, but never before had one member of the public been able on request to be put into communication directly with any other member of the public. Any momentary break in the continuity of the circuit must interrupt conversation, and the continuity of the circuit depended upon the proper working of numerous springs and movable contacts. You may imagine the trying time of the pioneer in remedying defects, whilst, at the same time, carrying out a new service with most sensitive and intricate apparatus. The early switchboards of ten lines had soon grown so that by means of what was known as the multiple switchboard 10,000 lines could be handled in one central office.

The fact that the public themselves were participants in the carrying out of the service introduced a new factor which had to be taken care of. This necessitated the introduction of methods of management and control as well as the adaptation of appliances, and only by careful study and steady application were satisfactory methods of exchange management developed. Metallic circuits in town areas were first introduced for long-distance (or trunk) subscribers, but it was early realised that they must become general, and eventually they did. The plan adopted was to draw cables into conduits, but in London it was necessary to reconstruct the system overhead in consequence of the refusal of local authorities to permit the use of the streets.

With the doubling of the line circuits necessarily followed the construction of metallic-circuit switchboards. The metallic-circuiting called for a modification in the subscribers' instrument, but not an entire change; the call was still made by turning the handle of a magneto. Yet another reconstruction of exchanges and replacement of subscribers' instruments followed the introduction of the central-battery system, which is familiar to you all from daily use. Whilst generally regarded as comparatively new, automatic systems which are now claiming more attention are almost coincident with manual systems, and have developed from very early beginnings.

In 1878 the telephone was first used in exchange service. To-day there are about twenty-one million telephones connected to exchanges throughout the world. In their first

business circular, issued in 1877, Bell and his associates stated that they were "prepared to furnish telephones for the transmission of articulate speech through instruments not more than twenty miles apart." To-day conversation has been accomplished over five thousand miles. An Indo-European telephone is scientifically possible, and conversation between London and Constantinople is by no means an idle dream.

Of legislation with regard to telephony the dominant factor is the Act of 1869. This was passed by Parliament in anticipation of the purchase of the telegraphs by the State, and was interpreted by the Courts as covering the means of communication by telephone. I see no reason to doubt the accuracy of the interpretation, which made the telephone a monopoly of the Government. The method of licensing was adopted, and the Telephone Co. became a licensee of the State.

When the telephone was introduced the nation had recently purchased the telegraphic business for several million pounds, and approached the subject from the shopkeeper's narrow view of conserving its immediate interests as a vendor of telegraphic service. The licence provided for the payment of a substantial royalty in consideration of the permission to do business; a central point was decided upon in each area and the licensee permitted to give communication within a specified radius—generally about four or five miles—because the telegraph revenue in local areas was small, but became more important as the distance increased. It is a matter for regret that there was no one of sufficient authority to take a broader view of what the nation might gain by improved communication by telephone as a set-off against a possibly reduced revenue from telegraphs.

Only once did the Government take a broad view, and that was when Mr. Fawcett, as a result of public protest, abolished the four-mile radius and allowed the companies to connect up where they liked. The more or less compulsory purchase of the trunk lines of the company introduced a recognised defect in having two authorities manipulating a single call, and was promoted as a set-off to the decreasing traffic from long-distance telegrams.

From the beginning great stress was laid on the importance of competition, but as time went on it became clear that competition in telephony was wasteful in any case, and not of advantage to the public. The question is sometimes asked whether our telephonic development is what it should be in view of our commercial importance and social standards. The telephonic development has been checked by the refusal of local authorities to allow underground cables. These bars to progress were instituted with the firm but misguided conviction that the interests of the ratepayers were being conserved. The loss which the same ratepayers were incurring by lack of communication was not thought of.

So far as telephony is concerned the period of divided interests is over. The keenness felt by the technical staff from the chief downwards for telephone progress and development is within our knowledge. Public appreciation of telephones is still uninformed. The subscriber still thinks of the cost of the instrument he sees, and is oblivious of the vast investment behind it. It is distressing to note the constant criticism of rates based on profound ignorance of the facts. We should do our best to support the sound principle that the service must be paid for by the users and in proportion to use.

In no branch of our industry has more thorough and systematic effort been made to utilise the discoveries of science and apply them by inventive ingenuity to the use and convenience of the public than in the case of telephony. In the discoveries of science we here may claim, and will certainly be allowed, an honoured place. In many of the applications we cannot overlook the predominant share of the United States. In the main the telephone organisations of the United States have had freedom to carry out a wise policy of development early formulated by the pioneers and steadily maintained since. The conditions in this country have been exactly the reverse, with consequences to national economy and efficiency which are serious. A bold policy is now needed, and there is no time to lose.

(To be continued.)

NOTES FROM CANADA.

(From Our Special Correspondent.)

The electrification of the lines of the Timiskaming and Northern Ontario Railway Co., which runs through the great metal mining district of Northern Ontario, is being considered, and it is also stated that the Michigan Central Railway is contemplating electrification of its Canadian lines between Niagara Falls and Windsor—a distance of about 240 miles.

In St. John's, New Brunswick, the employés of the New Brunswick Power Co., which operates the tramways, went on strike last summer, and formed a rival company under the name of the Union Bus Co. The latter company is reported to have failed recently, after having spent some $15,000 on 'buses alone.

The Hydro-Electric Power Commission of Ontario is building another 110,000-volt transmission line from Niagara Falls to Toronto, a distance of about 80 miles, and when this is ready there will be transmission-line capacity between these two places of 200,000 h.p.

According to data published in November last by the Canadian Pacific Railway Co., "there are 700 branch factories of United States industries operating in Canada and not less than 200 other American factories seeking Canadian locations." In discussing the reasons why so many United States firms have Canadian branches, the writer of the article from which this quotation is made cites the following: The depreciated purchasing power of the Canadian dollar in the United States; export orders received by the parent company for shipment to places within the British Empire can be handled with greater facility and more expeditiously through a branch house manufacturing in Canada; preferential tariffs within the British Empire; branches in Canada are within easier reach of Canadian markets. The following extract is of interest: "Canada, through organisations of every nature, its railways, its incorporated cities and towns, its civic bodies and boards of trade, offers every inducement to new industries to locate on its broad expanse. In no country is greater encouragement given to foreign manufacturers to locate, whilst the expanding domestic market and the rapidly growing export trade furnish a sure and steady output for products."

According to the *Canadian Engineer*, the report of the International Joint Commission gave some consideration to the question of the electrification of railways in connection with the proposed development of the St. Lawrence River. The report states that in the zone considered from Lake Erie to the Quebec boundary there is 36,000 miles of railway on both sides of the line (presumably the international boundary line between the U.S. and Canada). Of these railway lines, 19,000 miles could be electrified at a cost of $560,000,000, based on 1919 costs, but about 8,900,000 tons of coal would be saved annually, resulting in a yearly saving of $81,000,000, or 14.2 per cent. on the investment.

From time to time reference has been made in these notes to the fact that the Hydro-Electric Power Commission of Ontario was planning a scheme of electric radial railways, which would operate at high speed and carry both passengers and freight. Several lines connecting various cities were voted upon by the people and approved of by large majorities in most cases. There came a day, however, when a new Provisional Government came into office, towards the end of 1919. This Government decided that it should have a full investigation as to the merits of these radial railways and appointed a Royal Commission of Inquiry. The findings of this Royal Commission were adverse to the project of constructing these railway lines, at least at the present time, and as a result the whole matter has been held up as the Premier has expressed his determination to abide by the report of the Commission.

Many of the "Hydro" municipalities are incensed at the action of the Government and have declared their intention of going ahead with the construction of the "radials" on their own account, because the Government has positively refused to guarantee the bonds. At the present time the situation is acute, for the Premier has just stated that the Government will hold firmly to its attitude on the question, even though it may be compelled to resign, while many of the municipalities are openly defiant against the Government. What the outcome will be it is impossible to say at present but, if the Government should win, it is likely that the powers of the Hydro-Electric Power Commission will be considerably curtailed, or it may even be abolished and its work put into the hands of a "Ministry of Power" which would be specially created for the purpose.

The Premier states publicly that he believes in, and favours, public ownership of hydro-electric power, but the "pro-hydro" element of the population prefers to see in the Government's attitude the working of "private interests" which desire nothing so much as the abolition of public ownership.

Another matter which is agitating the public mind at present is the great cost of the Queenston-Chippawa Power Development at which the Government expresses alarm on account of the actual expenditure per horse-power being much in excess of the original estimates, which were made before the war caused such great increases in costs of material and labour.

The Westinghouse Co., in the United States, established a radio telephone service at East Pittsburgh, Pennsylvania, about a year ago, which is taken advantage of by many people in Canada and three more large stations have been added since.

Bedtime stories for children, talks to farmers, sailors, and others, besides the transmission of grand opera music (from Chicago) are some of the items on the programmes of these stations.

British Trade Ship.—Postponement.—Mr. Frank Benson, speaking at a meeting of the Newcastle Rotary Club on February 24th, on the British trade ship, said that at an important meeting of the directors in London on the previous day, it had been decided to put the scheme back a year, owing to the depressed state of trade. It would probably go in 1924.—*Morning Post.*

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Lamp-lock for Use on Board Ship.

It is the proud boast of Messrs. "Lamlok," Ltd., of 36, Rusthall Avenue, Chiswick, W.4, that they can cope with any problem in connection with the locking of lamps with which they are confronted. Such a case occurred recently, when it was found that certain shades used on board ship were of a shape which did not permit of using the ordinary "Lamlok" locking ring, owing to the restricted space available.

To meet this condition, a new type of ring has been evolved, as shown in figs. 1 and 2; it retains the channel and slots,

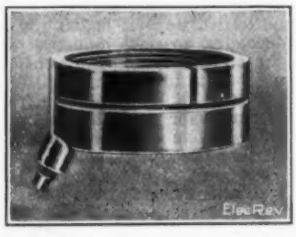

Fig. 1.—A New "Lamlok" Locking Ring.

with the addition of a locking screw set in obliquely, which can be turned with a simple key inserted between the lamp and even the narrowest shade. The screw is slackened back until the lamp is in place; the ring is then rotated a trifle, to bring the screw opposite one of the slots, with which it engages when screwed home, so that the ring cannot possibly be moved, and the lamp is securely locked in position.

Fig. 2.—The "Lamlok" Locking Ring in Position.

Another improvement in the ring consists in the addition of an internally threaded portion, which screws over the threaded barrel of the holder. Unfortunately, the degree of uniformity attained in the construction of lamp-holders leaves a good deal to be desired, and, in fact, the diameter over the threads varies appreciably; to provide for this difficulty, the screwed portion of the ring is slit half-way round the circumference and again at right-angles, the resulting spring action enabling the ring to be screwed on any lamp-holder with ease. Patent rights have been obtained for these modifications.

Our view of the holder and ring, fig. 2, shows also the "Lamlok" cord-grip, which clamps the flexibles against the porcelain and does away with the annoyance and waste of time arising out of the use of the wooden grips and nut.

The "Genii" Immersion Heater.

Messrs. George Nobbs, Ltd., 89, Cleveland Street, Fitzroy Square, W.1, have sent us one of their new "Genii" water boilers, which is illustrated in fig. 3. As will be seen, the device consists of a length of metal tubing formed into a helix. The helix is 2¼ in. in external diameter and 2 in. high. The two ends of the tube are fixed into an ebonite cap. Three terminal plugs are mounted on the top of this cap, and from these the heating elements pass through the tube and back again. An ebonite part with three sockets is used to connect the device *via* a length of flex and an adaptor to a lamp-holder. The purpose of the triple terminal is to make the appliance suitable for use on circuits of from 100 to 120 V, or from 200 to 250 V. Marks on the outside of the two ebonite parts ensure the correct arrangement of the terminals. The weight of the heater is only 11 oz., its over-all length is 9¾ in., and the loading represents about 500 W. The actual radiating surface amounts to 34 sq. in. The "Genii" heater

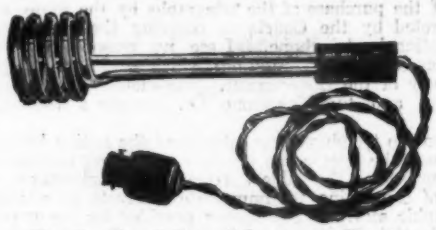

Fig. 3.—The "Genii" Immersion Heater.

is tested at 500 V, and one out of every five is run at full heat in air for 15 minutes.

The "Oldham" Miner's Cap Lamp.

The electric lamp is gradually supplanting all other types in mines because of its convenience, safety, and efficiency, and the cap type is probably the most popular form of electric lamp.

The improved pattern of cap lamp manufactured by Messrs. Oldham & Son, Ltd., Denton, near Manchester, is a good example of its kind, and embodies a number of features which render it popular. The full equipment, illustrated in fig. 4, consists of a canvas and leather cap, an accumulator in a strong case, a length of c.t.s. cable, and the lamp. The accumulator is of compact design, and made by a special process. The plates are of "staggered" grid cage pattern, with a continuous sheet of active material interlocked between the grids on each side. The terminal bar and plates are lead-burned together, which ensures greater strength than when the bar is cast on to the plates. The plates are fitted into a celluloid case with spring plunger terminals and grease cups. The lamp fitting consists of a strong aluminium outer case, a closely-fitting aluminium reflector, and the front glass is secured by a screwed lens-ring. The lamp itself is a special 2-V bulb. A single-pole screw-down rotary switch is mounted on the accumulator container and insulated from it. The container is secured by a magnetic lock. Fig. 5 shows the equipment in use.

Fig. 4.—The "Oldham" Cap Lamp Equipment.

Fig. 5.—The "Oldham" Equipment in Use.

A Combined Fan and Heater.

Within the past few weeks we have described two forms of combined electric fans and heaters. A third is illustrated in

Fig. 6.—A Combined Fan and Heater.

fig. 6 (reproduced from the Canadian *Electrical News*). This is a compact apparatus bearing a strong likeness to a motor

horn. The fan motor is mounted at the back of a two-part heating element. A four-position switch is fitted in the base. This switch acts as follows:—Its first position sets the fan in motion; the second point switches in a low-heat element of 660 W; the third turn cuts in an additional 1,320 W; the last point switches off both fan and heater. The device, which weighs only 12 lb., is made by an American firm, the Carmean Electric Co., of 2806-2808, East 18th Street, Kansas City, Mo.

LEGAL.

Scottish Steelmakers and Works Valuation.

The Lands Valuation Appeal Court in Edinburgh, on February 23rd, gave its decision in the cases stated on behalf of steelmakers in Lanarkshire against the determination of the Valuation Committee raising the yearly rent or value of the works. The Assessor, it may be recalled, arrived at his annual value on what is known as "the contractors' principle." The Valuation Committees approved of the method adopted by the Assessor, but were of opinion that the percentages suggested by him were rather high, particularly in the case of machinery, the shorter-lived portion of which had been eliminated from the calculation by the Committees' finding that it was non-rateable. They suggested an abatement of 30 per cent., which the Assessor contended was unprecedented.

The Court sustained the determination of the Valuation Committees, and refused the appeals.

Lord Salvesen, in the course of a long opinion, said the Assessor raised certain questions which turned on the meaning of "first motive power." The first related to electricity which was generated by means of steam-driven machinery. It was not disputed that the steam-driven machinery was rateable as well as the boilers. But the Assessor claimed that the dynamos actuated by the steam-driven machinery should also be included as heritable, apparently on the ground that the electric current so produced was used to operate machines in the appellants' works. In his Lordship's opinion the Assessor's view was negatived in the Guardbridge Paper Co.'s case last year, where their Lordships held that the boilers, the steam engines, and the main shafting all fell within the definition of plant or machinery for the purpose of producing or transmitting first motive power, but that when this power was transmitted by secondary shafting to the manufacturing machines it ceased to be first motive power. His Lordship thought this view governed the other matters raised by the Assessor. In these cases "the first motive power" was derived from an outside power company, and the appellants admitted that the cables and motors within their works were rateable. They maintained, however, that where the current was converted, it ceased to be first motive power. The appellants did not challenge the finding of the Committees as to rotary converters, where the place of the rotary converter was taken by a motor and a generator which served the same purpose as the rotary converter, the motor was rightly held to be machinery for producing or transmitting first motive power, but the generator which adapted the current to the uses of the machinery employed in the works was, his Lordship thought, in a different position, and really was employed to produce secondary motive power. He was accordingly for repelling the Assessor's contention on this point also.

Lord Cullen, speaking on the question of the meaning of "first motive power," said he thought it was unfortunate that the Court, in common with assessors and Valuation Committees, should be called upon to solve such fine questions relating to electrical machinery on an application of a somewhat crudely expressed statute, which, obviously enough, was not framed in special view of the rapid developments in the use of electricity for motive power which had taken place since its date. The application of the words of the Act to such questions seemed to him to involve often what was little more than guess-work, and he thought it would be very beneficial if the views of the legislature were expressed in an amending statute better adapted to the present state of affairs.

Hamilton *v.* Marconi's Wireless Co. and Another.

This action was down for hearing before the Lord Chief Justice and a special jury on February 24th, and on the case being called, Mr. Douglas Hogg, K.C., appearing with Mr. Bevan for the defendants, took a preliminary objection, and asked the Lord Chief Justice to look at the pleading, from which he would find that the plaintiff could not open his case without committing a contempt of court in view of an undertaking, which he had given in former Chancery proceedings, that a certain agreement between him and the company should not be published. Counsel quoted authorities in support of his action in dealing with the matter before the defendant opened his case.

Mr. Hamilton, who appeared in person, contended that the undertaking was obtained by misrepresentation, and that he did not fully understand its purport when he gave it.

The Lord Chief Justice pointed out that he could not get over the fact that the undertaking had been given, and said that before the case could proceed plaintiff would have to go to the Chancery Division to get the undertaking set aside.

After some argument, the case was stayed, with costs against the plaintiff.

British Thomson-Houston Co., Ltd., *v.* Semco, Ltd.

In the Chancery Division on Friday, before Mr. Justice Eve, Mr. Whitehead moved on behalf of the plaintiffs for an injunction to restrain the defendants from infringing the plaintiffs' patent rights. The defendants' solicitors had written saying they did not propose to resist the application, which referred to patents as to half-watt lamps which had been the subject of recent litigation in the House of Lords and before his Lordship. His Lordship granted the application.

Is an Electric Truck a Light Locomotive?

With further reference to the summoning of an employé of the British Electric Vehicles, Ltd., Churchtown, Southport, for driving an electric truck, manufactured by the company, on the public highway without a licence (Elec. Rev., February 3rd, p. 155), according to the *Manchester Guardian*, the Chief Constable stated on Monday at the Southport Police Court that the company had now been satisfied that its employés could not drive these trucks along the public highway without having a licence, and on an undertaking being given that this regulation would be complied with in future the case was dismissed on payment of costs.

PARLIAMENTARY NOTES.

Barking Electric Scheme.—In the House of Commons on Monday, Captain Martin asked the Parliamentary Secretary to the Ministry of Transport whether he could say when the County of London Electric Supply Co. would commence operations in connection with its scheme at Barking, which was approved in the latter part of 1921 by the Electricity Commissioners; and whether he would endeavour to facilitate the commencement of the work in view of the serious unemployment now prevailing in the East London area?

Mr. Arthur Neal replied:—It is not possible to say when the company will commence the construction of its generating station at Barking. The Company's Act of 1921 empowers the Electricity Commissioners, when giving their consent to the construction of the station, to prescribe the terms on which the undertaking may be acquired by the proposed Joint Electricity Authority for Greater London. With the object of facilitating the commencement of the work, the Commissioners have communicated the terms to the company, and it is anticipated that formal sanction to proceed with the work will be given shortly.

The Electricity Supply Bill.—The Earl of Onslow has introduced in the House of Lords a Bill to amend the law in respect of the supply of electricity.

North Metropolitan Electric Power Bill.—The *Financial Times* states that petitions have been lodged in the Private Bill Office of the House of Lords praying that when this Bill comes before a Select Committee of the House the following petitioners may be heard in opposition:—Middlesex County Council, South Metropolitan Electric Light and Power Co., companies supplying electrical energy within the Administrative County of London, Hackney Borough Council, Tottenham Urban District Council, London County Council, Southgate Urban District Council, County of London Electric Supply Co.

The Census of Production.—In reply to a Parliamentary question, the President of the Board of Trade said the census of production proposed to be taken next year would be postponed as recommended by the Geddes Committee.

A Swedish Manufacturing Company.—According to the *Svensk Handelstidning*, the directors of the Almänna Svenska Elektrisk A.B. have sent out the following announcement concerning the past year:—"The result of Asea's activity during the year 1921 has now become known. The working has left a loss of about 11,800,000 kronen. The loss has arisen from the specially violent fall in prices in the year and the incomplete occupation of all the company's departments. The directors propose that the loss should be covered out of the balance of 300,000 kr. brought forward by the appropriation of 3,500,000 kr. from the profit equalisation fund, and that the balance of 8,000,000 kr. should be met by a transfer from the reserve fund of 30,000,000 kr. The company's liquidity, however, is specially satisfactory." Commenting on this announcement, the Swedish journal states that it has long appeared from the exchange quotation for the company shares that the past year was particularly unfavourable for the company. The keen competition from Germany, in association with the heavy fall in the prices of the company's manufactures and stocks of raw materials, already asserted itself in the second half of 1920, and was reflected in the accounts for that year by a great diminution in the profits from 8,020,000 kr. in 1919 to 4,020,000 kr. in 1920, and a reduction in the dividend from 12 to 6 per cent.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sipton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

3,701. "Live rails in systems of electric traction." G. Ellson and Managing Committee of the South-Eastern & London, Chatham and Dover Railway Companies. February 8th.
3,703. "Electric tubular annealing, &c., furnaces." J. R. P. Lunn. February 8th.
3,704. "Connectors for concentric electric cables." J. R. P. Lunn. February 8th.
3,723. "Electric switches." H. H. Berry and Berry's Electric, Ltd. February 8th.
3,724. "Electric switches." H. H. Berry and Berry's Electric, Ltd. February 8th.
3,725. "Ignition magneto." C. Scal and E. Urbain. February 8th. (France, February 8th, 1921.)
3,728. "Commutators for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd., and T. N. Whitesmith. February 8th.
3,736. "Alternating-current generators." Siemens and Halske Akt. Ges. February 8th. (Germany, February 8th, 1921.)
3,741. "Electrical plug contacts." D. Lodder and G. Verdonk. February 8th. (Holland, February 9th, 1921.)
3,760. "Fixing covers for electric switches, &c." Fuller's United Electric Works, Ltd., and A. P. Welch. February 9th.
3,775. "Means for protecting joints of underground electric cables." H. J. Chaytor, H. Hawkins, and L. R. Lee. February 9th.
3,805. "Circuit connection fittings for electric wiring systems." L. M. Waterhouse. February 9th.
3,837. "Automatic switchstands for electric irons." G. Howson. February 9th.
3,843. "Electric circuit-controlling devices." P. G. Broom. February 9th.
3,849. "Electric accumulators." H. Leitner. February 9th.
3,862. "Manufacture of radiating-surfaces in electric heating apparatus." Soc. dite le Materiel. February 9th. (France, February 12th, 1921.)
3,868. "Thermo-electric apparatus for heating water, &c." V. Ortega. February 9th.
3,870. "Electric apparatus for destruction of insects, &c." A. Zaccanti. February 9th.
3,876. "Head-lights for motor, &c., vehicles." F. L. Rapson. February 9th.
3,914. "Electric switchboxes." L. J. Lepine. February 10th.
3,926. "Changeable electric code switch." J. A. E. A. Ellis. February 10th.
3,937. "Electric batteries." Soc. Anon Le Carbone. February 10th. (France, April 19th, 1921.)
3,969. "Devices for dimming incandescent electric lamps." J. R. Middleton and W. Williams & Co., Ltd. February 10th.
3,975. "Electric motor-control systems." British Thomson-Houston Co., Ltd. (General Electric Co.). February 10th.
3,980. "Electro-magnetic devices." H. C. E. Jacoby and New British Electric Supply Co., Ltd. February 10th.
3,982. "Telautography." H. G. Bartholomew and M. L. D. McFarlane. February 10th.
3,993. "Transmission and reproduction of sound." S. G. Brown. February 10th.
4,009. "Magneto-electric machine." G. Natoli. February 10th.
4,028. "Electrical transmitter microphones." E. D. Young. February 11th.
4,029. "Electric motor-controlling switchgear." C. C. Garrard, M. Solomon and W. Wilson. February 11th.
4,030. "Electric motor-starting and controlling switchgear." C .C. Garrard, A. H. Railing and W. Wilson. February 11th.
4,036. "Liquid variable condenser." A. Snow. February 11th.
4,053. "Control gear for electric-driving mechanism." Associated Equipment Co., Ltd., and C. K. Edwards. February 11th.
4,058. "Electric switches." A. Reyrolle & Co., Ltd., and H. W. Clothier. February 11th.
4,061. "Wireless receiving systems." E. Y. Robinson. February 11th.
4,063. "Electric inspection apparatus for interiors." A. J. Dean. February 11th.
4,078. "Receiving arrangements for electro-magnetic waves." T. H. Kinman. February 11th.
4,079. "Motor head-lights." W. Cook. February 11th.
4,109. "Electro-dynamic power-transmitting mechanism." J. N. Chaviara and J. F. Gill. February 11th.
4,116. "Electric terminals for wall plugs and sockets, switches, &c." C. L. Arnold and C. R. Belling. February 13th.
4,119. "Electric ignition gear for two-stroke cycle engines." L. H. Hounsfield. February 13th.
4,132. "Magnetos and drive thereof." A. Page. February 13th.
4,134. "Head light for motor vehicles." A. Cairns. February 13th.
4,139. "Means for threading telephone, &c., cables through conduits, &c." E. L. Ward and A. E. Ward. February 13th.
4,157. "Impermeable electric apparatus." F. H. L. Holweck. February 13th. (France, February 11th, 1921.)
4,171. "Electric contact devices working with mercury, &c." K. Kaisser. February 13th.
4,179. "Electric time switches." J. Clifton, J. Robinson and J. Spenser. February 13th.
4,191. "Alternating-current dynamo-electric machines." A. B. Field, Metropolitan-Vickers Electrical Co., Ltd., and L. Miller. February 13th.
4,200. "Electro magnetic mechanism." A. E. Hudd and Automatic Telephone Manufacturing Co., Ltd. February 13th
4,201. "Automobile head light." E. E. Peck. February 13th.
4,203. "Alternating-current machines." F. Creedy. February 13th.
4,219. "Protective systems for alternating-current circuits." C. C. Garrard, A. E. McColl, A. H. Railing, and W. Wilson. February 13th.
4,265. "Sparking plugs." W. H. Duffett. February 14th.
4,270. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd. February 14th. (United States, February 14th, 1921.)
4,282. "Electric inductance coils, &c." B. H. N. H. Hamilton. February 14th.
4,300. "Electric power systems." P. Kemp. February 14th.
4,302. "Telephone number indicator." E. F. Joyce and C. C. R. Wray. February 14th.
4,304. "Accumulators." H. Leitner. February 14th.
4,305. "Electrically-driven clocks, &c." J. P. Haworth. February 14th.
4,318. "Repeater circuits." Western Electric Co., Ltd. February 14th. (United States, June 11th, 1921.)
4,319. "Electrical networks." Western Electric Co., Ltd. (Western Electric Co., Inc.). February 14th.
4,332. "Electric current controllers, &c." British Thomson-Houston Co., Ltd., and C. T. Hanna. February 14th.
4,334. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd. February 14th. (United States, February 26th, 1921.)
4,337. "Electric incandescent lamps." General Electric Co., Ltd., and R. Le Rossignol. February 14th.
4,339. "Metallic vapour lamp." P. Eversheim. February 14th.
4,351. "Telephone systems." D. C. Crowe. February 14th.
4,363. "Electric supply arrangements and apparatus for electrically-propelled vehicles and systems for propulsion thereof." O. Kurz. February 14th. (Austria, March 7th, 1921.)
4,367. "Dividing box for multi-core cables." D. D. Watson. February 14th.
4,368. "Electricity meters for alternating currents." L. T. C. Russell. February 14th.
4,378. "Regulating switch for starting electric motors, &c." W. F. Rowlandson. February 14th.
4,384. "Electrodes for heating liquids." O. Meyer Keller & Co. February 15th. (Germany, June 9th, 1921.)
4,390. "Boxes for carrying electric lamps." A. H. Stevenson. February 15th.
4,411. "Electrically-illuminated signs." S. T. Jeffreys. February 15th.
4,413. "Lightning or surge arresters for electric conductors." A. Reyrolle and Co., Ltd., and W. M. Thornton. February 15th.
4,447. "Apparatus for periodical interruption of electric current." H. Ackermann and P. J. Barnes. February 15th.
4,463. "Electrical speed regulator systems." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). February 15th.
4,467. "Electric circuit controllers." British Thomson-Houston Co., Ltd. (General Electric Co.). February 15th.
4,468. "Thermionic valves." H. G. Hughes, S. R. Mullard, and L. G. Preston. February 15th.
4,470. "Multiplex submarine cable." Western Electric Co. (Western Electric Co. Inc.). February 15th.
4,481. "Electro deposition of metals." T. W. S. Hutchins. February 15th.
4,485. "Electric switches." Hart Manufacturing Co. February 15th. (United States, February 24th, 1921.)
4,488. "Electric accumulators." A. Neumann and O. Neumann. February 15th. (Germany, January 5th.)
4,494. "Motor starters and circuit controllers." A. W. Burke. February 15th. (United States, February 15th, 1921.)
4,495. "Motor starters and circuit controllers." A. W. Burke. February 15th. (United States, August 13th, 1921.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

20,377. "Navigation by means of an alternating-current cable located in the water." H. Lichte. December 30th, 1918. (148,430.)
20,440. "Electrical annunciator and alarm devices particularly for burglar and fire alarms." G. Schmidt and Boker & Co. March 27th, 1918. (148,480.)
22,231. "Methods of and apparatus for receiving signals by wireless telegraphy." Hall Research Corporation. August 13th, 1919. (149,954.)
22,390. "Alternating-current electric motors." Carey Gavey Syndicate, Ltd., and K. Higginson. July 27th, 1920. (174,655.)
24,597. "Miners' electric lamps." E A. Hailwood. August 25th, 1920. (174,664.)
26,923. "Receivers for wireless signalling." O. Y. Imray (Executor of O. Imray, deceased), International Radio Telegraph Co., and J. L. Hogan. September 21st, 1920. (174,672.)
29,640. "Electric heaters." A. Selvatico. October 20th, 1920. (174,688.)
29,562. "Cooling of dynamo-electric machines." W. M. Selvey and L. R. Morshead. October 22nd, 1920. (174,693.)
30,122. "Electro pneumatic braking apparatus." T. H. Thomas. April 2nd, 1920. (161,150.)
30,278. "Magneto electric machines." R. B. North and A. Allen-Massey. October 26th, 1920. (Cognate application 13,280/21.) (174,701.)
30,287. "Wind-power electric generating plant." J. C. Hansen Ellehammer. October 26th, 1920. (174,703.)
30,396. "Electrical signalling apparatus." S. Sekal (Luftfahrzeugbau Schuttte Lanz). October 27th, 1920. (174,705.)
30,409. "Electric cooking vessels." G. Durando. November 20th, 1919. (154,183.)
30,552 "Filaments for incandescent electric lamps and the like." General Electric Co., Ltd., and F. S. Goucher. October 28th, 1920. (Cognate application 21,371/21.) (174,714.)
31,053. "Electric harmonic analyser." M. Walker. November 3rd, 1920. (Cognate application 32,378/20.) (174,744.)
31,243. "Magneto ignition of internal-combustion engines." F. W. Lancaster and Daimler Co., Ltd. November 4th, 1920. (174,758.)
31,310. "Nipple for use on cables or wires." L. Camillis. November 5th, 1920. (174,760.)
31,528. "Protective devices for electric distribution systems." British Thomson-Houston Co., Ltd., and H. Pearce. November 8th, 1920. (174,769.)
31,617. "Magneto electric ignition machines." R. Bosch Akt. Ges. April 24th, 1920. (162,634.)
32,101. "Cooling of sparking plugs and internal combustion engines of motor-cycles." New Hudson, Ltd., and A. A. Price. November 13th, 1920. (174,778.)
32,434. "Electric excess current indicators." E. Schattner. November 17th, 1920. (Addition to 138,835.) (174,785.)
32,733. "Electric switches." British Thomson-Houston Co., Ltd., and H. Trencham and E. B. Wedmore. November 19th, 1920. (174,793.)
32,747. "Brakes for electric tramcars and the like." C. J. Spenser. November 19th, 1920. (174,795.)
33,015. "Control of electric generating plant and switches therefor." H. J. Read and W. J. Bransom. November 23rd, 1920. (174,800.)
33,116. "Electric arc lamps." E. Heinz Raven. July 12th, 1920. (166,507.)
33,878. "Sparking plug." A. Ramsay. December 1st, 1920. (174,815.)
33,933. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. December 3rd, 1919. (154,613.)
33,956. "Apparatus for recording automatically the opening or the closing and the duration of incompletion or of completion of a plurality of electric circuits." Sir H. Darwin and Cambridge & Paul Instrument Co., Ltd. December 1st, 1920. (174,818.)
35,109. "Electric lamps used for signalling." D. T. Tritsch. December 14th, 1920. (174,831.)
35,498. "Electric lamps." C. E. P. Gabriel. December 17th, 1920. (174,835.)
35,845. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). December 21st, 1920. (174,837.)
35,950. "Electric apparatus for heating flowing liquids." R. C. Masseroni. May 24th, 1920. (163,974.)
36,132. "High-tension electric transformers." Veifa-Werke Vereinigte Elektro Technische Institute, Frankfurt Aschjaffenburg and Dessauer, Dr. F. October 7th, 1915. (Addition to 155,830.) (155,831.)
36,432. "Electric cut-outs." A. H. Railing, C. C. Garrard, and P. M. Coales. December 30th, 1920. (174,847.)

1921.

2,172. "Head-lights of motor-vehicles and the like." L. A. Dobson. January 16th, 1921. (174,856.)
6,523. "Construction of electric transformers." W. Parry. February 26th, 1921. (174,866.)
7,226. "Dynamo electric generators for lighting bicycles and the like." X. Bullinger. March 5th, 1921. (174,869.)
8,127. "Contact breakers for magnetos." Duten Doublet et Cie. March 19th, 1920. (160,420.)
13,825. "Methods for the parallel coupling of generators of polyphase current." Compagnie Générale Electrique. October 6th, 1920. (169,954.)
21,160. "High-frequency self-induction coils." E. Binard. August 10th, 1920. (167,767.)

1922.

500. "Electric high-frequency signalling." A. van T. Day. July 17th, 1916. (Divided application on 148,580.) (174,064.)